



FCC CFR47 PART 15 SUBPART E
INDUSTRY CANADA RSS-210 ISSUE 8

CERTIFICATION TEST REPORT

FOR

802.11a/g/n 3X3 MIMO WLAN + BT COMBO PCI-E MINI CARD

MODEL NUMBER: BCM94331PCIEBT4

FCC ID: QDS-BRCM1055
IC: 4324A-BRCM1055

REPORT NUMBER: 10U13492-3

ISSUE DATE: JANUARY 21, 2011

Prepared for
BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.

Prepared by
COMPLIANCE CERTIFICATION SERVICES (UL CCS)
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP[®]
NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	1/21/11	Initial Issue	T. Chan

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS.....	9
2. TEST METHODOLOGY	10
3. FACILITIES AND ACCREDITATION.....	10
4. CALIBRATION AND UNCERTAINTY	10
4.1. <i>MEASURING INSTRUMENT CALIBRATION.....</i>	10
4.2. <i>SAMPLE CALCULATION.....</i>	10
4.3. <i>MEASUREMENT UNCERTAINTY.....</i>	10
5. EQUIPMENT UNDER TEST	11
5.1. <i>DESCRIPTION OF EUT.....</i>	11
5.2. <i>MAXIMUM OUTPUT POWER.....</i>	11
5.3. <i>DESCRIPTION OF AVAILABLE ANTENNAS.....</i>	13
5.4. <i>SOFTWARE AND FIRMWARE.....</i>	13
5.5. <i>WORST-CASE CONFIGURATION AND MODE</i>	14
5.6. <i>DESCRIPTION OF TEST SETUP.....</i>	15
6. TEST AND MEASUREMENT EQUIPMENT	17
7. ANTENNA PORT TEST RESULTS	18
7.1. <i>802.11a MODE IN THE 5.2 GHz BAND.....</i>	18
7.1.1. 26 dB and 99% BANDWIDTH	18
7.1.2. OUTPUT POWER	21
7.1.3. PEAK POWER SPECTRAL DENSITY	24
7.1.4. PEAK EXCURSION	27
7.1.5. CONDUCTED SPURIOUS EMISSIONS.....	30
7.2. <i>802.11n THREE CHAINS HT20 MODE IN THE 5.2 GHz BAND</i>	34
CDD MCS0	34
STBC MCS0	35
7.2.1. 26 dB and 99% BANDWIDTH	35
7.2.2. OUTPUT POWER	38
7.2.3. PEAK POWER SPECTRAL DENSITY	45
7.2.4. PEAK EXCURSION	52
7.2.5. CONDUCTED SPURIOUS EMISSIONS.....	55
SDM MCS8	59
7.2.6. 26 dB and 99% BANDWIDTH	59
7.2.7. OUTPUT POWER	62
7.2.8. PEAK POWER SPECTRAL DENSITY	69
7.2.9. PEAK EXCURSION	76

7.2.10. CONDUCTED SPURIOUS EMISSIONS.....	79
SDM MCS12.....	83
7.2.11. 26 dB and 99% BANDWIDTH.....	83
7.2.12. OUTPUT POWER.....	86
7.2.13. PEAK POWER SPECTRAL DENSITY.....	93
7.2.14. PEAK EXCURSION.....	100
7.2.15. CONDUCTED SPURIOUS EMISSIONS.....	103
SDM MCS16.....	107
7.2.16. 26 dB and 99% BANDWIDTH.....	107
7.2.17. OUTPUT POWER.....	110
7.2.18. PEAK POWER SPECTRAL DENSITY.....	117
7.2.19. PEAK EXCURSION.....	124
7.2.20. CONDUCTED SPURIOUS EMISSIONS.....	127
SDM MCS21.....	131
7.2.21. 26 dB and 99% BANDWIDTH.....	131
7.2.22. OUTPUT POWER.....	134
7.2.23. PEAK POWER SPECTRAL DENSITY.....	141
7.2.24. PEAK EXCURSION.....	148
7.2.25. CONDUCTED SPURIOUS EMISSIONS.....	151
7.3. 802.11n HT40 S/ISO MODE IN THE 5.2 GHz BAND	155
SISO	155
7.3.1. 26 dB and 99% BANDWIDTH.....	155
7.3.2. OUTPUT POWER.....	157
7.3.3. PEAK POWER SPECTRAL DENSITY.....	159
7.3.4. PEAK EXCURSION.....	161
7.3.5. CONDUCTED SPURIOUS EMISSIONS.....	163
7.4. 802.11n DUAL CHAIN HT40 MODE IN THE 5.2 GHz BAND	166
STBC MCS0	166
7.4.1. 26 dB and 99% BANDWIDTH.....	166
7.4.2. OUTPUT POWER.....	168
7.4.3. PEAK POWER SPECTRAL DENSITY.....	171
7.4.4. PEAK EXCURSION.....	174
7.4.5. CONDUCTED SPURIOUS EMISSIONS.....	176
SDM MCS 8.....	179
7.4.6. 26 dB and 99% BANDWIDTH.....	179
7.4.7. OUTPUT POWER.....	181
7.4.8. PEAK POWER SPECTRAL DENSITY.....	185
7.4.9. PEAK EXCURSION.....	188
7.4.10. CONDUCTED SPURIOUS EMISSIONS.....	190
SDM MCS12	193
7.4.11. 26 dB and 99% BANDWIDTH.....	193

7.4.12. OUTPUT POWER	195
7.4.13. PEAK POWER SPECTRAL DENSITY.....	198
7.4.14. PEAK EXCURSION	201
7.4.15. CONDUCTED SPURIOUS EMISSIONS.....	203
7.5. <i>802.11n THREE CHAINS HT40 MODE IN THE 5.2 GHz BAND</i>	206
CDD MCS0	206
STBC MCS0	207
7.5.1. 26 dB and 99% BANDWIDTH	207
7.5.2. OUTPUT POWER	209
7.5.3. PEAK POWER SPECTRAL DENSITY.....	213
7.5.4. PEAK EXCURSION	217
7.5.5. CONDUCTED SPURIOUS EMISSIONS.....	219
SDM MCS8	222
7.5.6. 26 dB and 99% BANDWIDTH	222
7.5.7. OUTPUT POWER	224
7.5.8. PEAK POWER SPECTRAL DENSITY.....	228
7.5.9. PEAK EXCURSION	232
7.5.10. CONDUCTED SPURIOUS EMISSIONS.....	234
SDM MCS12	237
7.5.11. 26 dB and 99% BANDWIDTH	237
7.5.12. OUTPUT POWER	239
7.5.13. PEAK POWER SPECTRAL DENSITY.....	244
7.5.14. PEAK EXCURSION	248
7.5.15. CONDUCTED SPURIOUS EMISSIONS.....	250
SDM MCS16	253
7.5.16. 26 dB and 99% BANDWIDTH	253
7.5.17. OUTPUT POWER	255
7.5.18. PEAK POWER SPECTRAL DENSITY.....	260
7.5.19. PEAK EXCURSION	264
7.5.20. CONDUCTED SPURIOUS EMISSIONS.....	266
SDM MCS21	269
7.5.21. 26 dB and 99% BANDWIDTH	269
7.5.22. OUTPUT POWER	271
7.5.23. PEAK POWER SPECTRAL DENSITY.....	275
7.5.24. PEAK EXCURSION	279
7.5.25. CONDUCTED SPURIOUS EMISSIONS.....	281
7.6. <i>802.11a LEGACY MODE IN THE 5.3 GHz BAND</i>	284
7.6.1. 26 dB and 99% BANDWIDTH	284
7.6.2. OUTPUT POWER	287
7.6.3. PEAK POWER SPECTRAL DENSITY.....	290
7.6.4. PEAK EXCURSION	293
7.6.5. CONDUCTED SPURIOUS EMISSIONS.....	296
7.7. <i>802.11n THREE CHAINS HT20 MODE IN THE 5.3 GHz BAND</i>	300

CDD MCS0	300
7.7.1. 26 dB and 99% BANDWIDTH	300
7.7.2. OUTPUT POWER	303
7.7.3. PEAK POWER SPECTRAL DENSITY	313
7.7.4. PEAK EXCURSION	320
7.7.5. CONDUCTED SPURIOUS EMISSIONS	323
SDM MCS21	327
7.7.6. 26 dB and 99% BANDWIDTH	327
7.7.7. OUTPUT POWER	329
7.7.8. PEAK POWER SPECTRAL DENSITY	336
7.7.9. PEAK EXCURSION	340
7.7.10. CONDUCTED SPURIOUS EMISSIONS	342
7.8. <i>802.11n HT SISO 40 MODE IN THE 5.3 GHz BAND</i>	345
SISO	345
7.8.1. 26 dB and 99% BANDWIDTH	345
7.8.2. OUTPUT POWER	347
7.8.3. PEAK POWER SPECTRAL DENSITY	351
7.8.4. PEAK EXCURSION	353
7.8.5. CONDUCTED SPURIOUS EMISSIONS	355
7.9. <i>802.11n THREE CHAINS HT40 MODE IN THE 5.3 GHz BAND</i>	358
CDD MCS 0	358
7.9.1. 26 dB and 99% BANDWIDTH	358
7.9.2. OUTPUT POWER	360
7.9.3. PEAK POWER SPECTRAL DENSITY	368
7.9.4. PEAK EXCURSION	372
7.9.5. CONDUCTED SPURIOUS EMISSIONS	375
SDM MCS21	378
7.9.6. 26 dB and 99% BANDWIDTH	378
7.9.7. OUTPUT POWER	380
7.9.8. PEAK POWER SPECTRAL DENSITY	387
7.9.9. PEAK EXCURSION	391
7.9.10. CONDUCTED SPURIOUS EMISSIONS	394
7.10. <i>802.11a LEGACY MODE IN THE 5.6 GHz BAND</i>	397
7.10.1. 26 dB and 99% BANDWIDTH	397
7.10.2. OUTPUT POWER	400
7.10.3. PEAK POWER SPECTRAL DENSITY	405
7.10.4. PEAK EXCURSION	408
7.10.5. CONDUCTED SPURIOUS EMISSIONS	411
7.11. <i>802.11n THREE CHAINS HT20 MODE IN THE 5.6 GHz BAND</i>	415
CDD MCS0	415
7.11.1. 26 dB and 99% BANDWIDTH	415
7.11.2. OUTPUT POWER	418
7.11.3. PEAK POWER SPECTRAL DENSITY	428

7.11.4. PEAK EXCURSION	435
7.11.5. CONDUCTED SPURIOUS EMISSIONS.....	438
SDM MCS21	444
7.11.6. 26 dB and 99% BANDWIDTH	444
7.11.7. OUTPUT POWER	446
7.11.8. PEAK POWER SPECTRAL DENSITY.....	453
7.11.9. PEAK EXCURSION	457
7.11.10. CONDUCTED SPURIOUS EMISSIONS.....	459
7.12. 802.11n HT40 SISO MODE IN THE 5.6 GHz BAND	464
SISO	464
7.12.1. 26 dB and 99% BANDWIDTH	464
7.12.2. OUTPUT POWER	467
7.12.3. PEAK POWER SPECTRAL DENSITY.....	472
7.12.4. PEAK EXCURSION	475
7.12.5. CONDUCTED SPURIOUS EMISSIONS.....	478
7.13. 802.11n THREE CHAINS HT40 MODE IN THE 5.6 GHz BAND	482
CDD MCS0	482
7.13.1. 26 dB and 99% BANDWIDTH	482
7.13.2. OUTPUT POWER	485
7.13.3. PEAK POWER SPECTRAL DENSITY.....	494
7.13.4. PEAK EXCURSION	500
7.13.5. CONDUCTED SPURIOUS EMISSIONS.....	503
SDM MCS21	511
7.13.6. 26 dB and 99% BANDWIDTH	511
7.13.7. OUTPUT POWER	514
7.13.8. PEAK POWER SPECTRAL DENSITY.....	523
7.13.9. PEAK EXCURSION	530
7.13.10. CONDUCTED SPURIOUS EMISSIONS.....	533
8. RADIATED TEST RESULTS	541
8.1. <i>LIMITS AND PROCEDURE</i>	541
8.2. <i>TRANSMITTER ABOVE 1 GHz</i>	542
8.2.1. 802.11a MODE IN THE 5.2 GHz BAND	543
8.2.2. 802.11a MODE IN THE 5.3 GHz BAND.....	545
8.2.3. 802.11a MODE IN THE 5.6 GHz BAND	547
802.11n HT20 THREE CHAINS MODE IN THE 5.2 GHz BAND (CDD MCS0)	548
8.2.4. 802.11n HT20 THREE CHAINS MODE IN THE 5.2 GHz BAND (SDM MCS16)	
551	
8.2.5. 802.11n HT20 THREE CHAINS MODE IN THE 5.2 GHz BAND (SDM MCS21)	
553	
8.2.6. 802.11n HT20 THREE CHAINS MODE IN THE 5.3 GHz BAND (CDD MCS0)	555
8.2.7. 802.11n HT20 THREE CHAINS MODE IN THE 5.6 GHz BAND (CDD MCS0)	557
8.2.8. 802.11n HT40 SISO MODE IN THE 5.2 GHz BAND	560
8.2.9. 802.11n HT40 SISO MODE IN THE 5.3 GHz BAND	562
8.2.10. 802.11n HT40 SISO MODE IN THE 5.6 GHz BAND	564

8.2.11.	802.11n HT40 THREE CHAINS MODE IN THE 5.2 GHz BAND (CDD MCS0)	566
8.2.12.	802.11n HT40 THREE CHAINS MODE IN THE 5.2 GHz BAND (STBC MCS0)	567
8.2.13.	802.11n HT40 THREE CHAINS MODE IN THE 5.3 GHz BAND (CDD MCS0)	568
8.2.14.	802.11n HT40 THREE CHAINS MODE IN THE 5.3 GHz BAND (SDM MCS21)	571
8.2.15.	802.11n HT40 THREE CHAINS MODE IN THE 5.6 GHz BAND (CDD MCS0)	573
8.2.16.	802.11n HT40 THREE CHAINS MODE IN THE 5.6 GHz BAND (SDM MCS21)	576
8.3.	<i>RECEIVER ABOVE 1 GHz</i>	578
8.3.1.	20 MHz BANDWIDTH	578
8.3.2.	40 MHz BANDWIDTH	579
8.4.	<i>WORST-CASE BELOW 1 GHz</i>	580
9.	AC POWER LINE CONDUCTED EMISSIONS	581
10.	DYNAMIC FREQUENCY SELECTION	584
10.1.	<i>OVERVIEW</i>	584
10.1.1.	LIMITS	584
10.1.2.	TEST AND MEASUREMENT SYSTEM	587
10.1.3.	SETUP OF EUT	590
10.1.4.	DESCRIPTION OF EUT	591
10.2.	<i>RESULTS FOR 20 MHz BANDWIDTH</i>	592
10.2.1.	TEST CHANNEL	592
10.2.2.	RADAR WAVEFORM AND TRAFFIC	592
10.2.3.	OVERLAPPING CHANNEL TESTS	594
10.2.4.	MOVE AND CLOSING TIME	594
10.3.	<i>RESULTS FOR 40 MHz BANDWIDTH</i>	599
10.3.1.	TEST CHANNEL	599
10.3.2.	RADAR WAVEFORM AND TRAFFIC	599
10.3.3.	OVERLAPPING CHANNEL TESTS	601
10.3.4.	MOVE AND CLOSING TIME	601
10.3.5.	NON-OCCUPANCY PERIOD	606
11.	MAXIMUM PERMISSIBLE EXPOSURE	607
12.	SETUP PHOTOS	611

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, USA

EUT DESCRIPTION: 802.11a/g/n 3x3 MIMO WLAN + BT Combo PCI-E Mini Card

MODEL: BCM94331PCIEBT4

SERIAL NUMBER: 6

DATE TESTED: NOVEMBER 15, 2010 to JANUARY 19, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 9	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services (UL CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For UL CCS By:



THU CHAN
ENGINEERING MANAGER
UL CCS

Tested By:



VIEN TRAN
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/g/n 3x3 MIMO WLAN + BT Combo PCI-E Mini Card.

The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz BAND, 1x3			
5180 - 5240	802.11a	16.35	43.15
5190 - 5230	SISO HT40	16.60	45.71
5.2 GHz BAND, 3x3 HT20 MODE			
5180 - 5240	STBC MCS 0	14.24	26.55
5180 - 5240	SDM MCS 8	14.32	27.04
5180 - 5240	SDM MCS 12	14.20	26.30
5180 - 5240	SDM MCS 16	15.07	32.14
5180 - 5240	SDM MCS 21	14.37	27.35
5.2 GHz BAND, 2X2 HT40 MODE			
5190 - 5230	STBC MCS 0	16.67	46.45
5190 - 5230	SDM MCS 8	16.86	48.53
5190 - 5230	SDM MCS 12	16.89	48.87
5.2 GHz BAND, 3x3 HT40 MODE			
5190 - 5230	STBC MCS 0	16.77	47.53
5190 - 5230	STBC MCS 8	16.84	48.31
5190 - 5230	SDM MCS 12	16.80	47.86
5190 - 5230	SDM MCS 16	16.83	48.19
5190 - 5230	SDM MCS 21	16.52	44.87

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.3 GHz BAND, 1x3			
5260 - 5320	802.11a	18.90	77.62
5270 - 5310	SISO HT40	21.52	141.91
5.3 GHz BAND, 3x3 HT20 MODE			
5260 - 5320	CDD MCS 0	16.96	49.66
5260 - 5320	SDM MCS 21	20.53	112.98
5.3 GHz BAND, 3X3 HT40 MODE			
5270 - 5310	CDD MCS 0	18.64	73.11
5270 - 5310	SDM MCS 21	23.11	204.64
5.6 GHz BAND			
5500 - 5700	802.11a	20.26	106.17
5510 - 5670	SISO HT40	22.39	173.38
5.6 GHz BAND, 3X3 HT20 MODE			
5500 - 5700	CDD MCS0	18.57	71.94
5500 - 5700	SDM MCS21	21.40	138.04
5.6 GHz BAND, 3X3 HT40 MODE			
5510 - 5670	CDD MCS0	18.53	71.29
5510 - 5670	SDM MCS21	22.89	194.54

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes three 802.11agn antennas, with a maximum gain as below table;

2x2-ANTENNA

K90	Antenna Gain		Antenna Gain
	Ant 1 GHz	Ant 2 GHz	
Ant 1 dB_i	Ant 2 GHz	Combined dB_i	
5.2	6.02	5.96	9.00
5.3	6.80	6.17	9.51
5.6	7.06	6.26	9.69

3x3-ANTENNA

K90	Antenna Gain			Antenna Gain
	Ant 1 GHz	Ant 2 GHz	Ant 3 GHz	
Ant 1 dB_i	Ant 2 GHz	Ant 3 GHz	Combined dB_i	
5.2	6.02	5.96	5.50	10.60
5.3	6.80	6.17	5.59	10.99
5.6	7.06	6.26	5.97	11.23

5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed during testing was Broadcom, rev. 5.100.98.17.
The test utility software used during testing was BCM Internal, rev. 5.100.RC98.17.

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT was tested as an external module installed in a test jig board connected to a host Laptop PC.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:

For 5GHz Band:

All final tests in the 802.11a Legacy mode were made at 6 Mb/s.

All final tests in the 802.11n 20 MHz CDD/SDM mode were made at MCS0.

All final tests in the 802.11n 40 MHz CDD/SDM mode were made at MCS0.

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power, that was determined to be 11n HT20 mode, mid channel..

For MIMO conducted spurious measurement preliminary testing showed that combiner is worst-case compared to individual chains; therefore final measurements were performed using combiner for all channels and modes.

For MIMO PSD measurement preliminary testing to individual chains; therefore final measurements were performed using individual chains for all channels and modes.

For radiated band edge measurements preliminary testing showed that the worst case was vertical polarization, so final measurements were performed with vertical polarization.

All legacy modes were measured with the highest gain for each type of antenna.

All MIMO modes were measured with the highest combination of gains for each type of antenna. Note that this combination of antennas will not be implemented in the end product. This combination was selected for testing purposes only, to accommodate the highest gain of each antenna type in one single test configuration. The combined gain of this test configuration is higher than any combined gain that will be implemented in the end product.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST					
Description	Manufacturer	Model	Serial Number	FCC ID	
Laptop	Dell	Inspiron 0000	CN-9010003-70166-57K-01JS	DoC	
AC Adapter	Dell	ADP-60NH B	MOW0528000191	DoC	
Adapter Board	Catalyst	MINI2EXP	BRCM 07	N/A	
Adapter Board	Broadcom	BCM94331PCIBT4HAD	241	N/A	

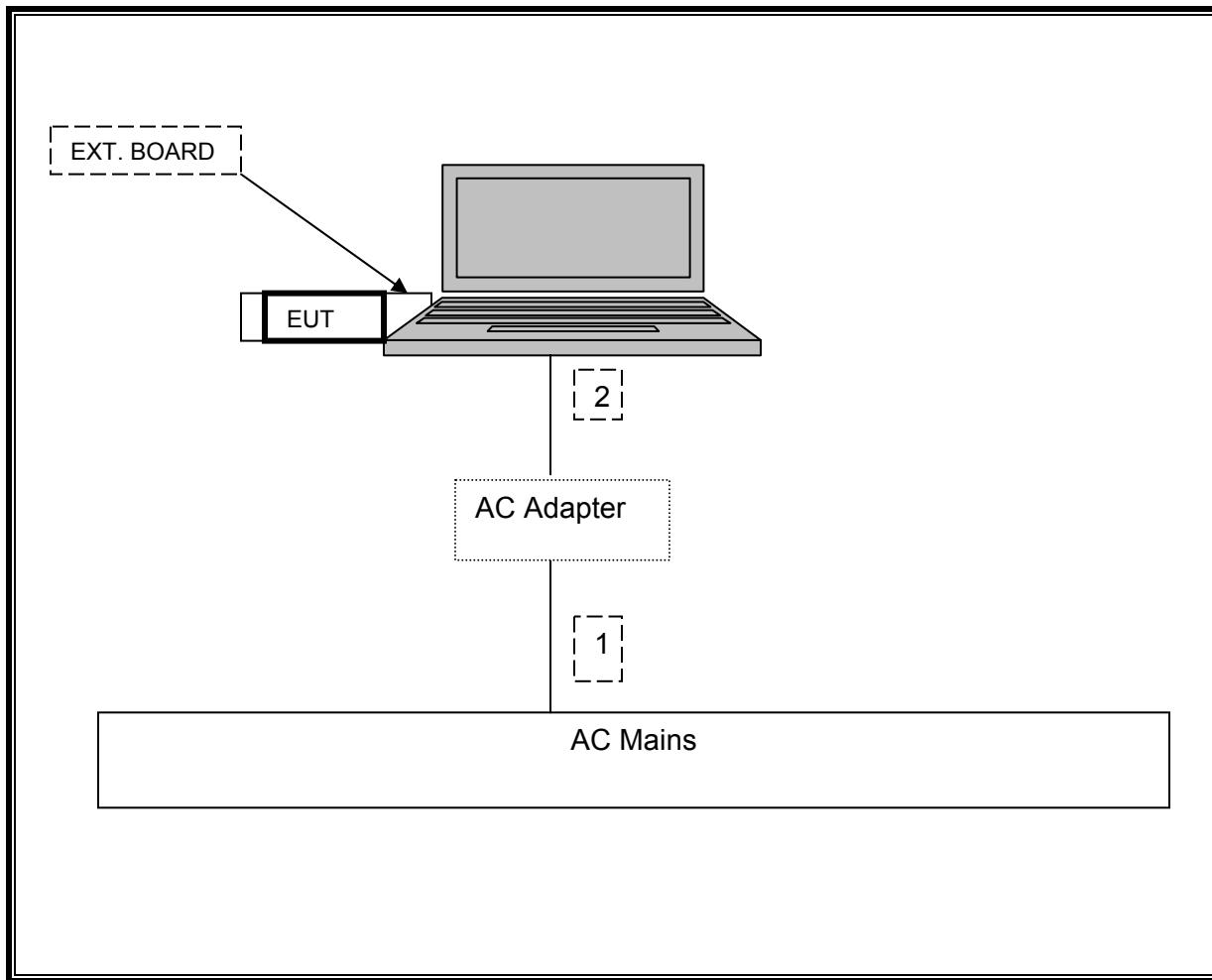
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US 115V	Shielded	1.5m	NA
2	DC	1	DC	Un-shielded	1.5m	Ferrite at laptop's end

TEST SETUP

The EUT is attached to a jig board which is installed in the PCI Express slot of a host laptop computer during the tests. Test software exercised the radio card.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	07/14/11
Antenna, Horn, 18 GHz	EMCO	3115	C00872	07/29/11
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	07/29/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00778	07/06/11
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	08/04/11
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	10/29/11
Peak Power Meter	Agilent / HP	E9327A	C00964	12/04/11
Peak Power Sensor	Agilent / HP	E4416A	C00963	12/04/11
EMI Receiver, 6.5 GHz	Agilent / HP	8546A	1963	08/19/11
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02679	CNR
Reject Filter, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02680	CNR
Reject Filter, 5.47-5.725 GHz	Micro-Tronics	BRC13191	N02678	CNR
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-	N02481	11/05/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/12

7. ANTENNA PORT TEST RESULTS

7.1. 802.11a MODE IN THE 5.2 GHz BAND

7.1.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

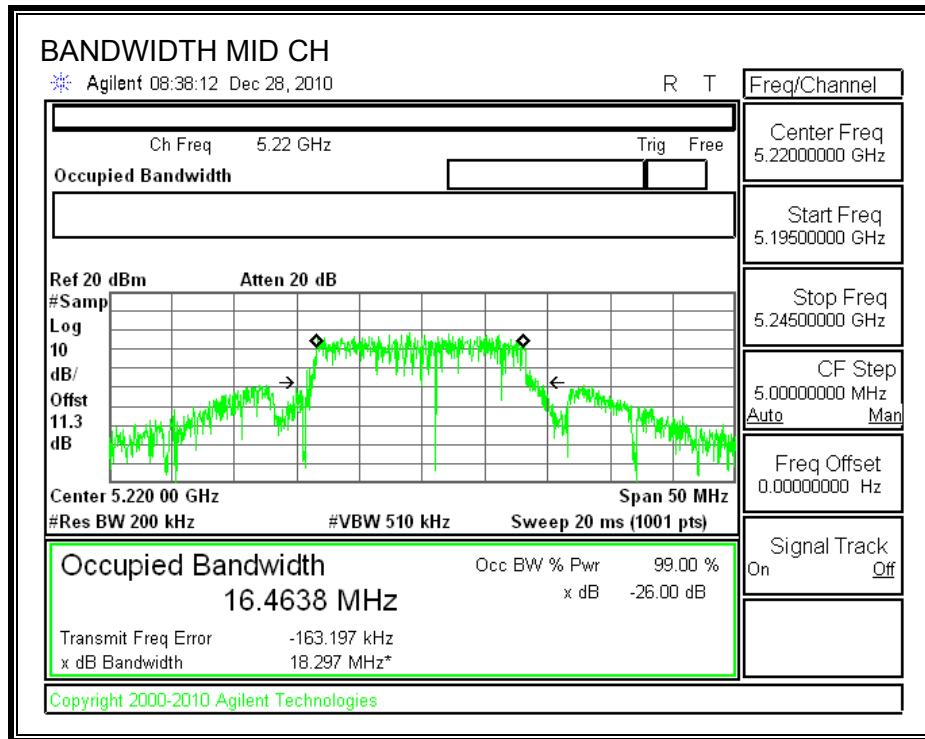
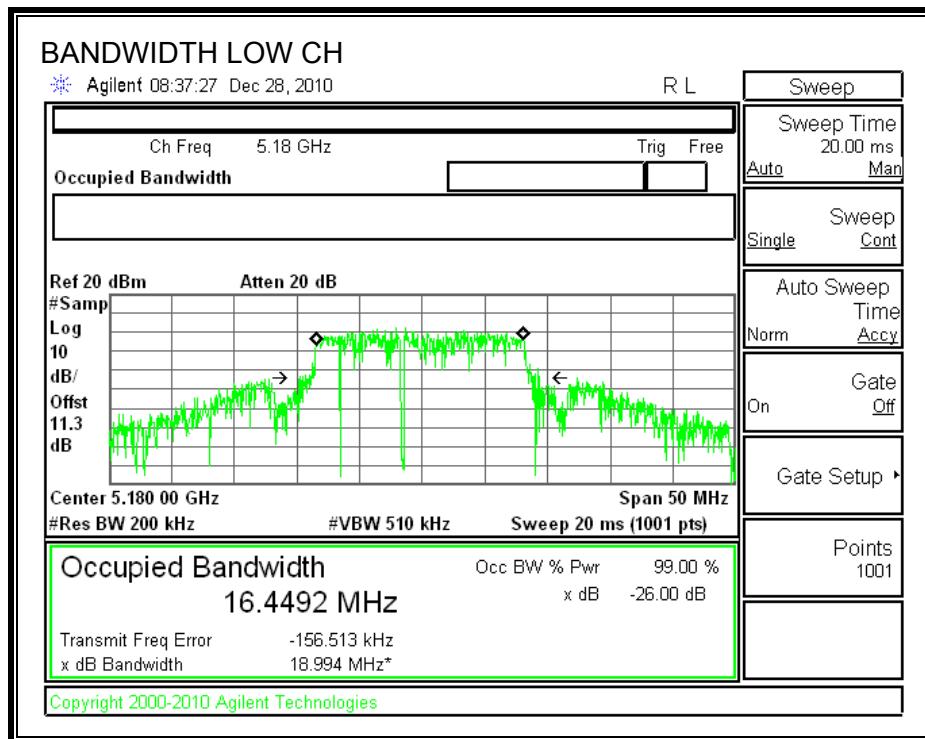
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	18.994	16.4492
Middle	5200	18.297	16.4638
High	5240	18.553	16.4396

26 dB and 99% BANDWIDTH





7.1.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

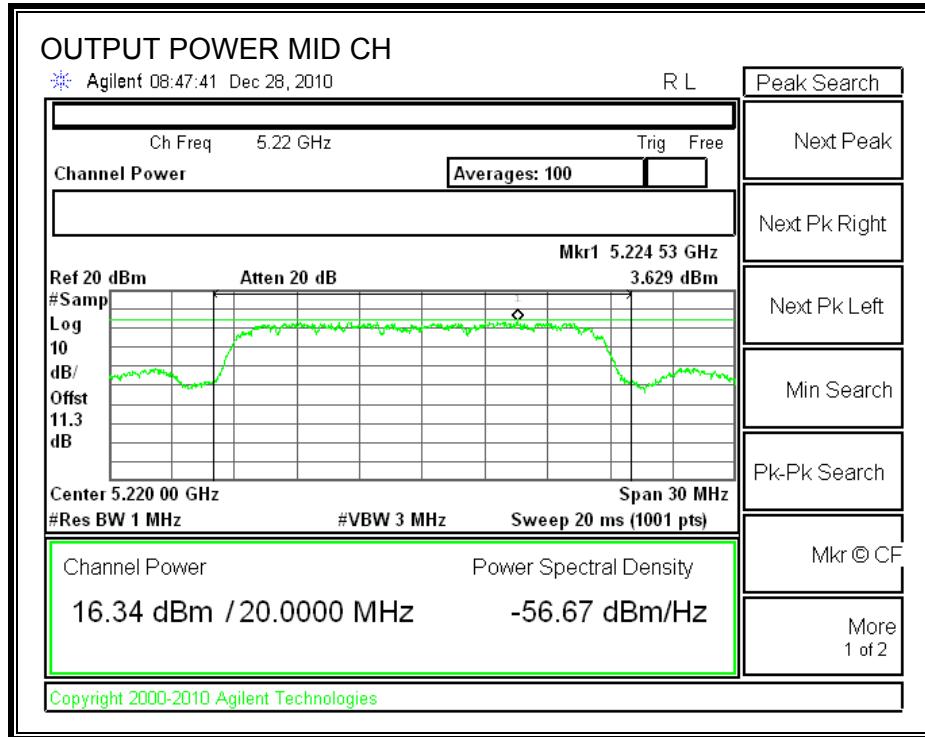
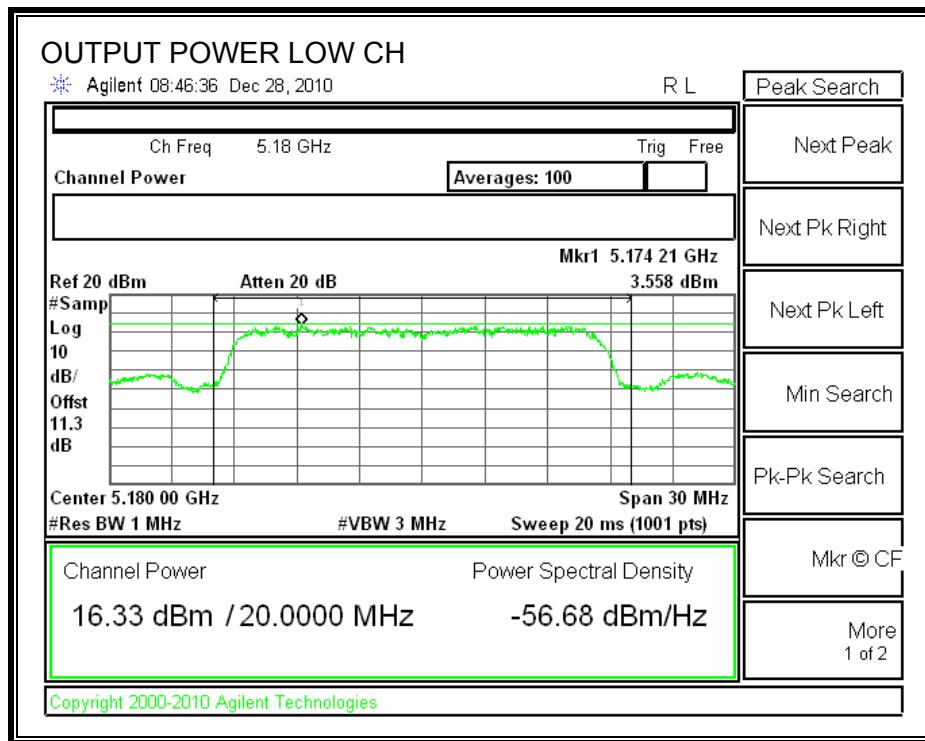
Limit

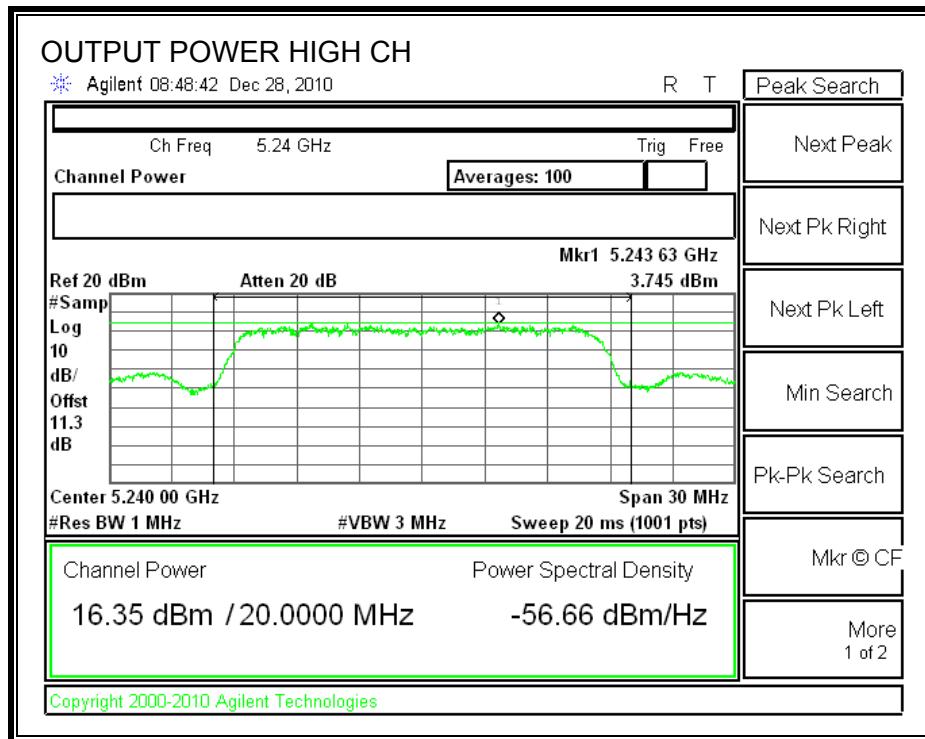
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	17	18.994	16.79	6.02	16.77
Mid	5200	17	18.297	16.62	6.02	16.60
High	5240	17	18.553	16.68	6.02	16.66

Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	16.33	16.77	-0.44
Mid	5200	16.34	16.60	-0.26
High	5240	16.35	16.66	-0.31

OUTPUT POWER





7.1.3. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 6.02 dBi, therefore the limit is 3.98 dBm.

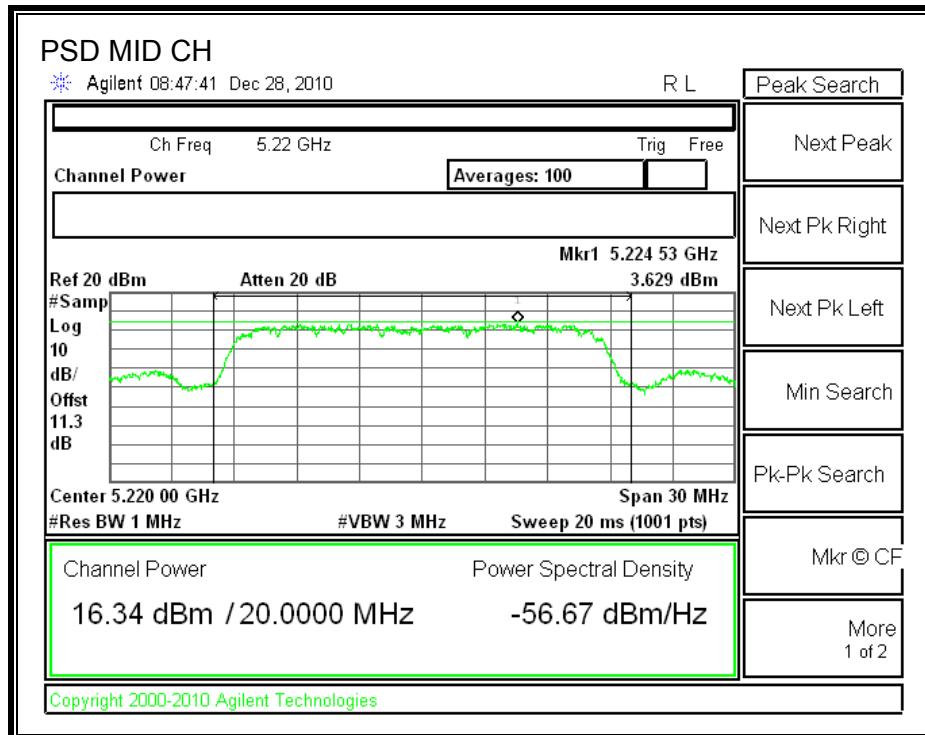
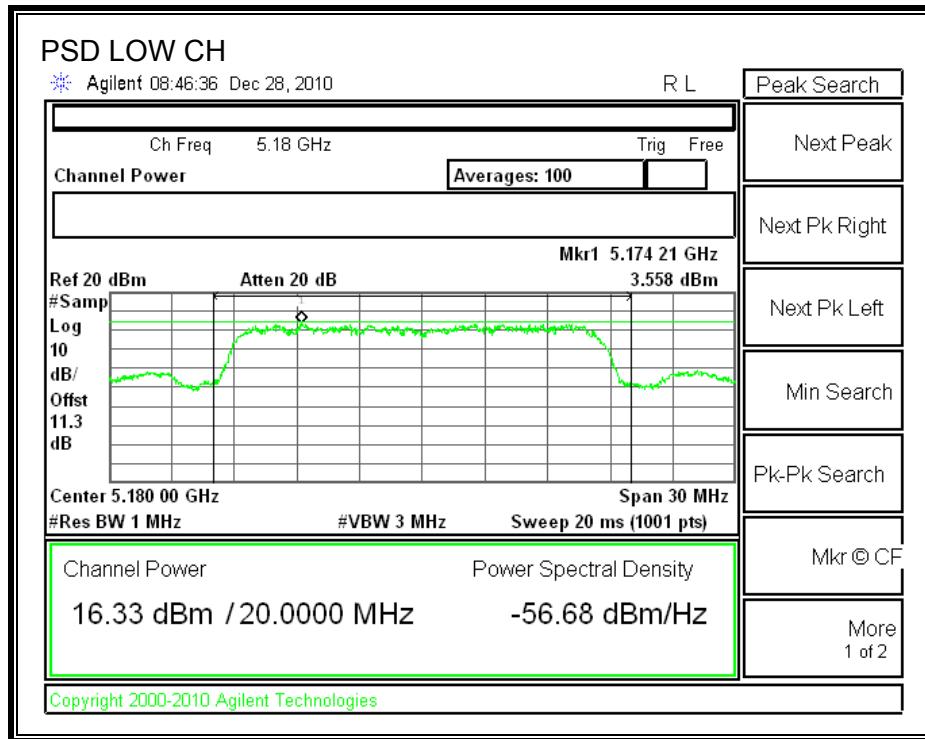
TEST PROCEDURE

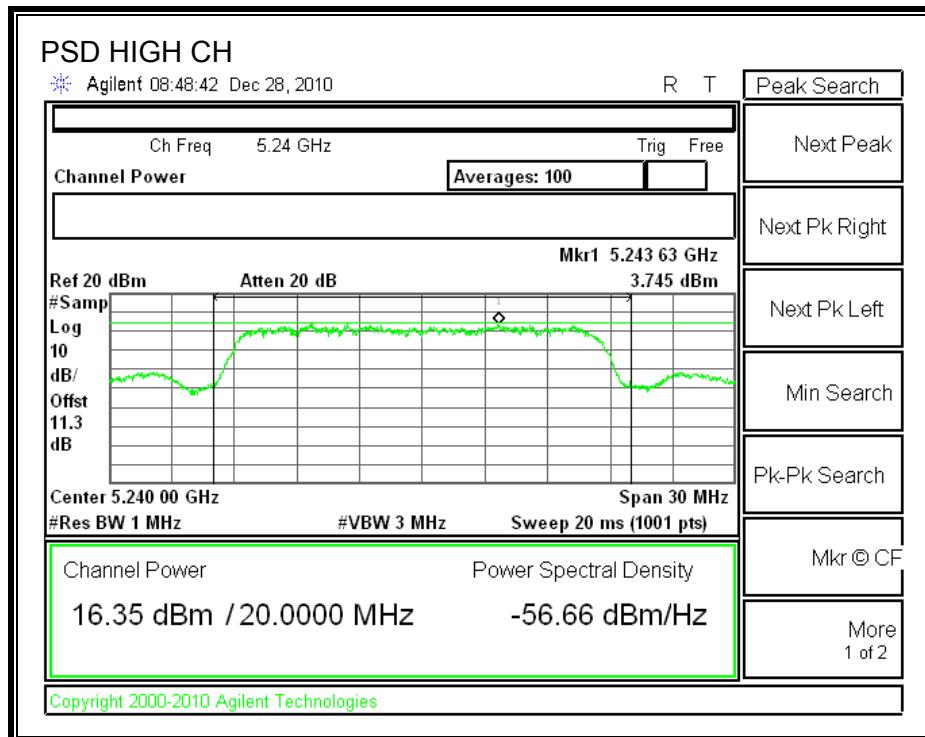
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.558	3.98	-0.42
Middle	5200	3.629	3.98	-0.35
High	5240	3.745	3.98	-0.24

POWER SPECTRAL DENSITY





7.1.4. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

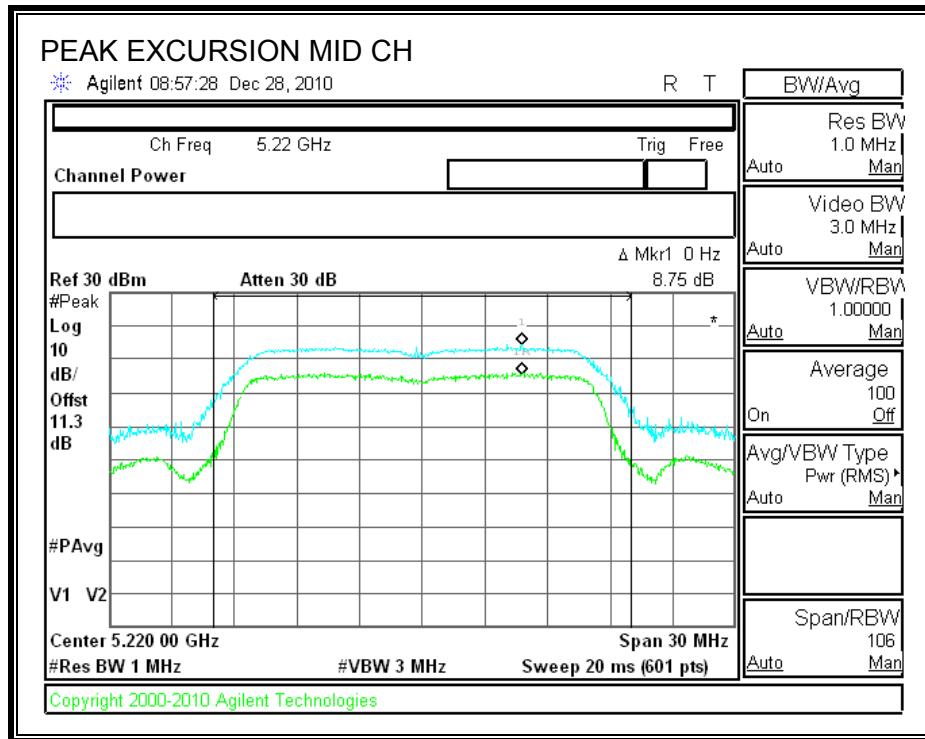
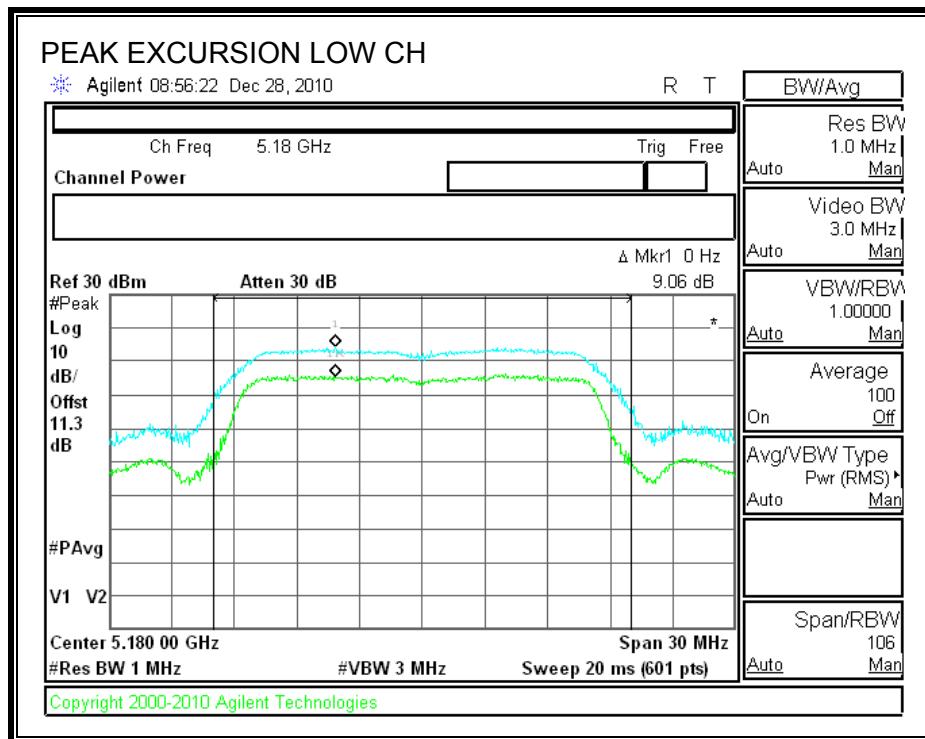
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

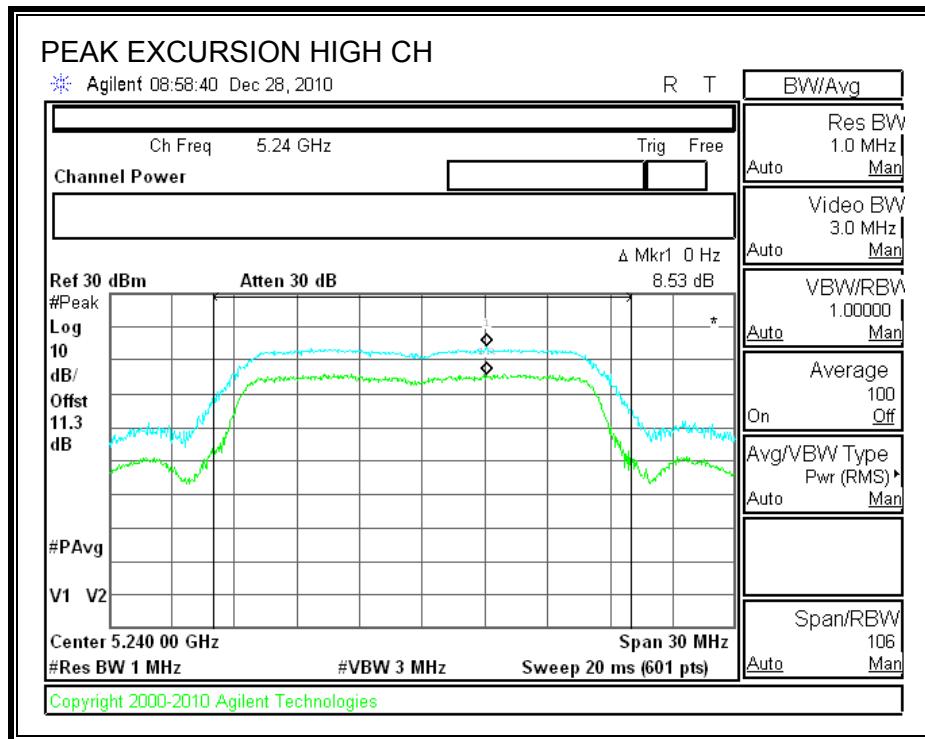
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.06	13	-3.94
Middle	5200	8.75	13	-4.25
High	5240	8.53	13	-4.47

PEAK EXCURSION





7.1.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

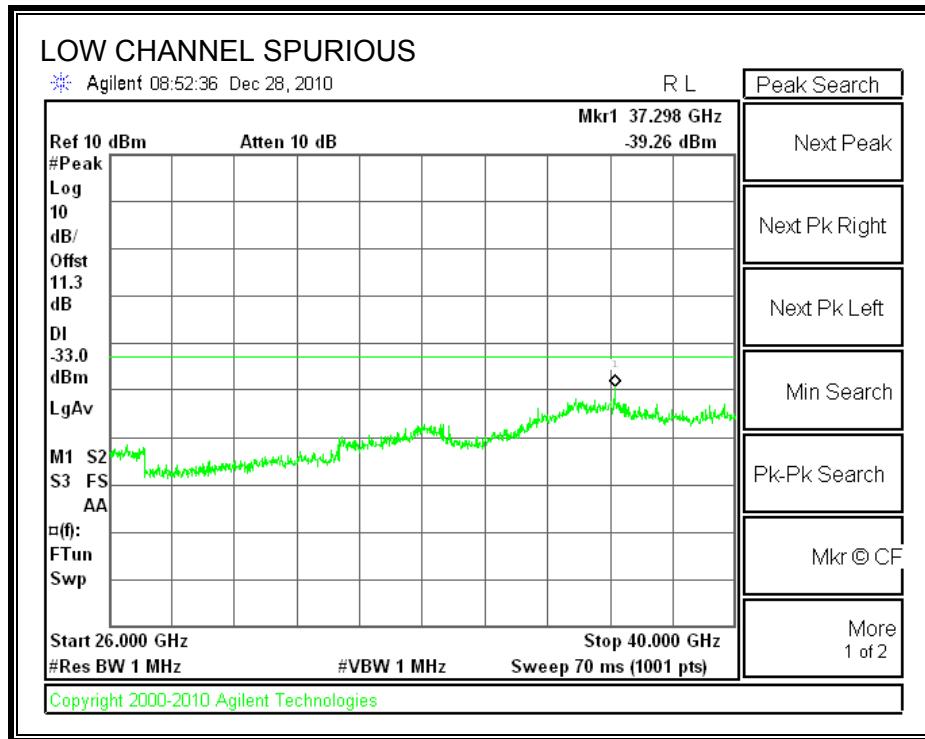
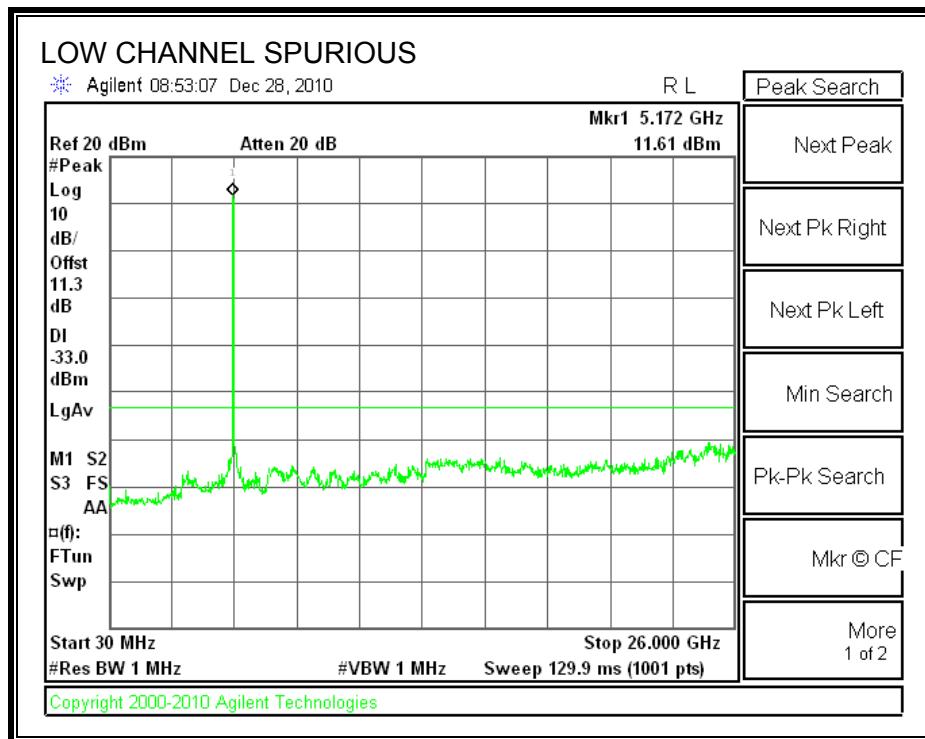
TEST PROCEDURE

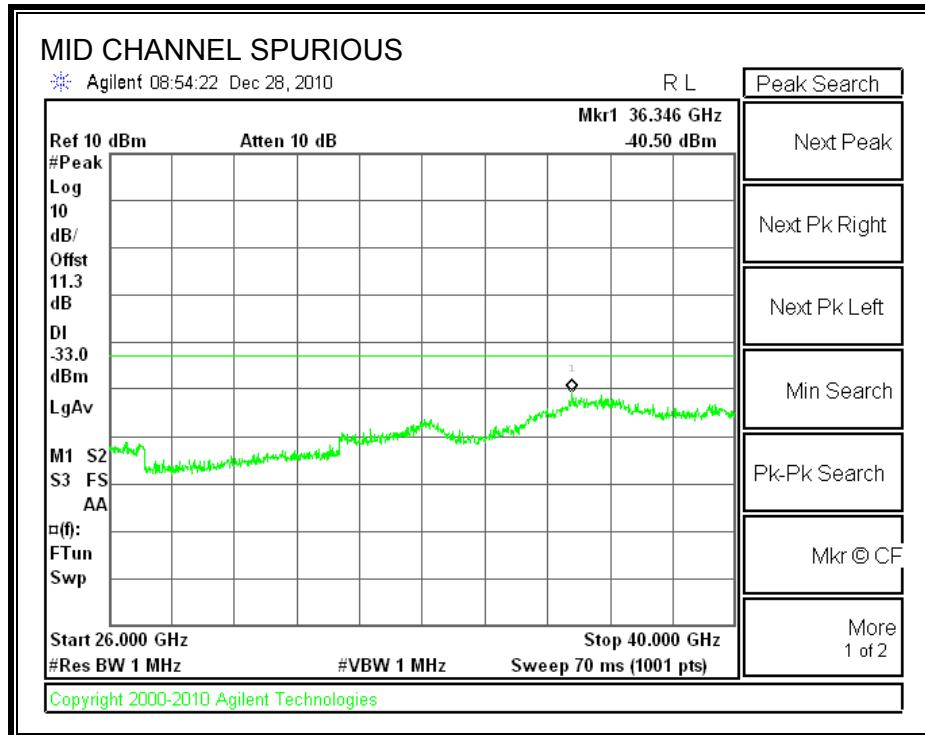
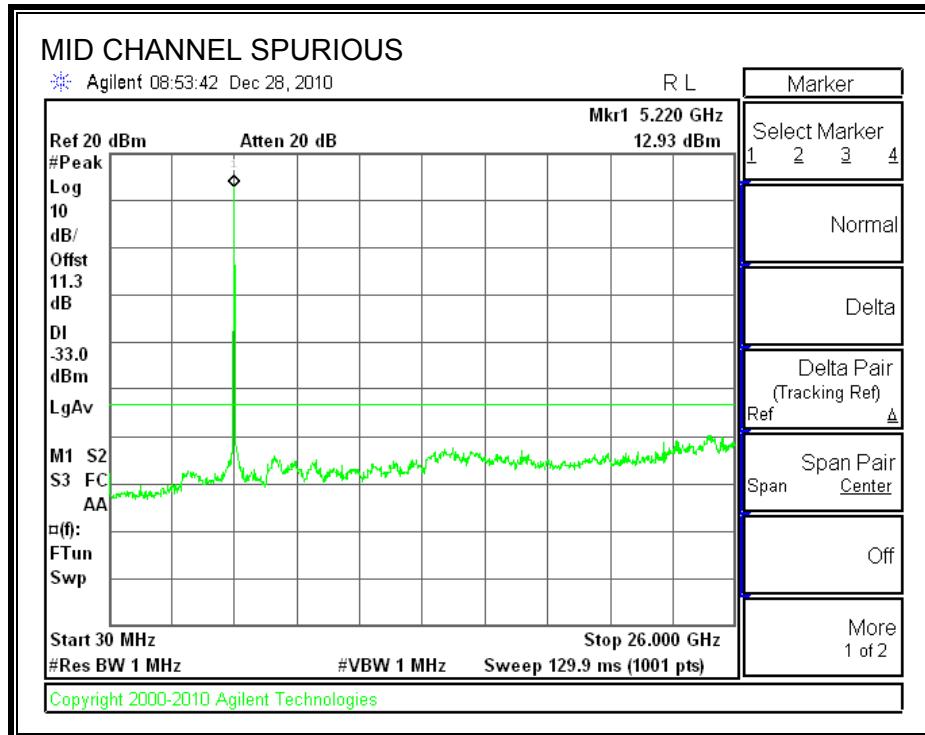
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

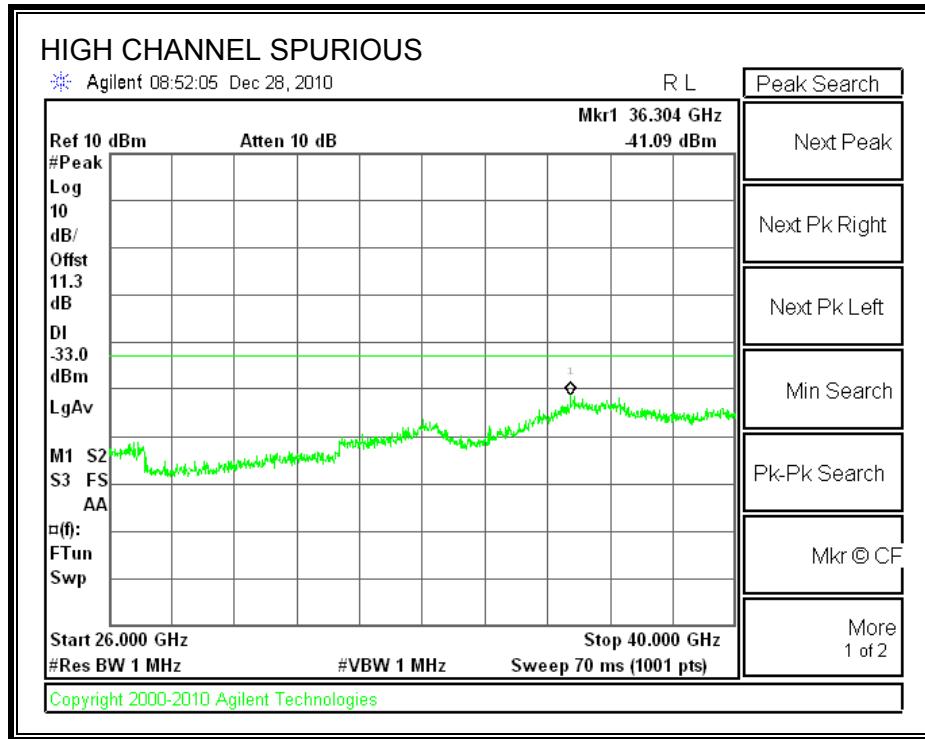
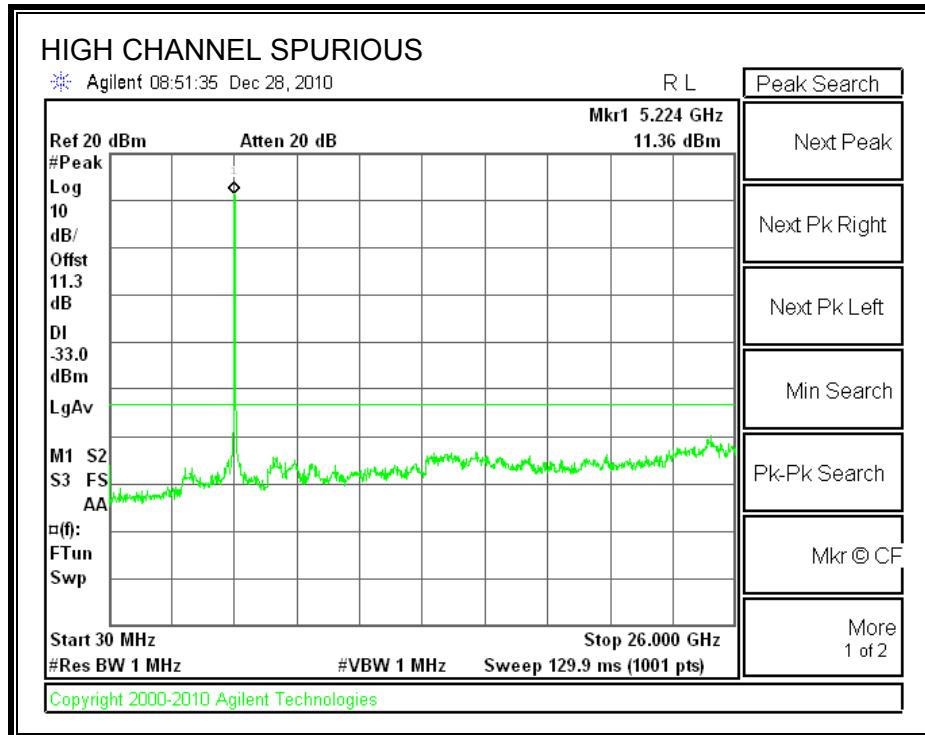
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS







7.2. 802.11n THREE CHAINS HT20 MODE IN THE 5.2 GHz BAND

CDD MCS0

This mode is not implemented in the 5.2 GHz band and will be disabled in production devices.

Preliminary testing demonstrated that CDD MCS0 was the worst case of various HT20 modes, therefore radiated measurements in the CDD MCS0 mode were performed.

STBC MCS0

7.2.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

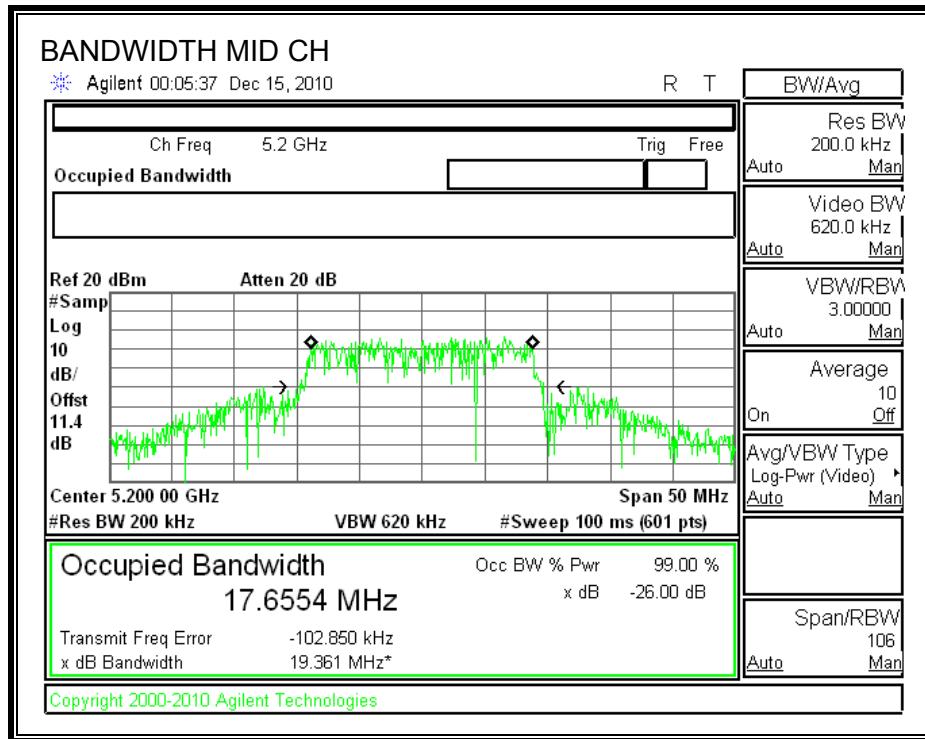
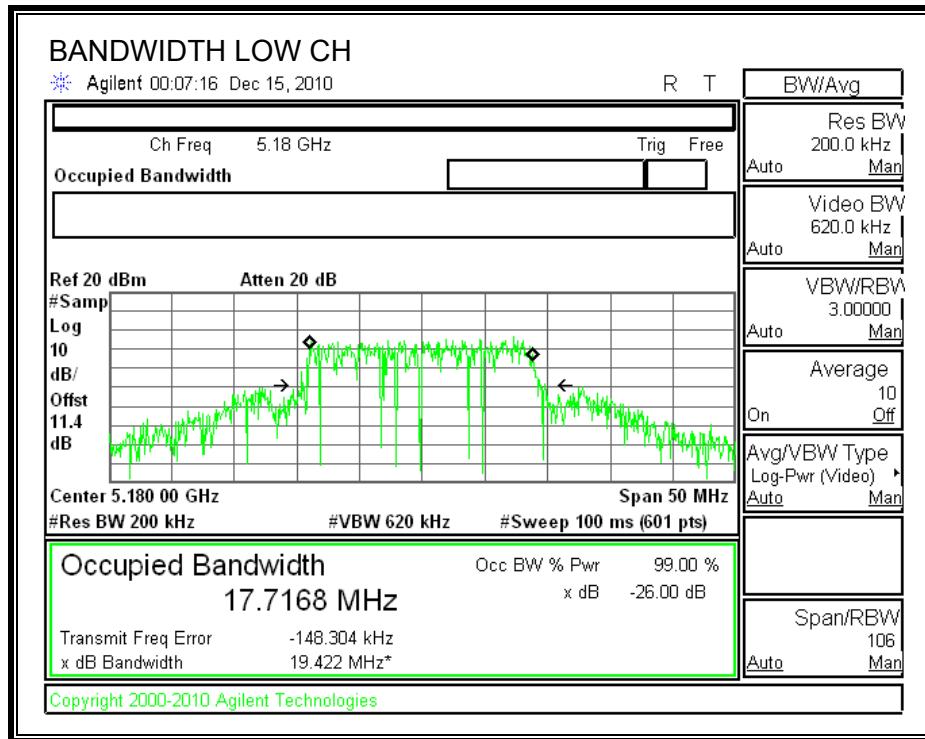
TEST PROCEDURE

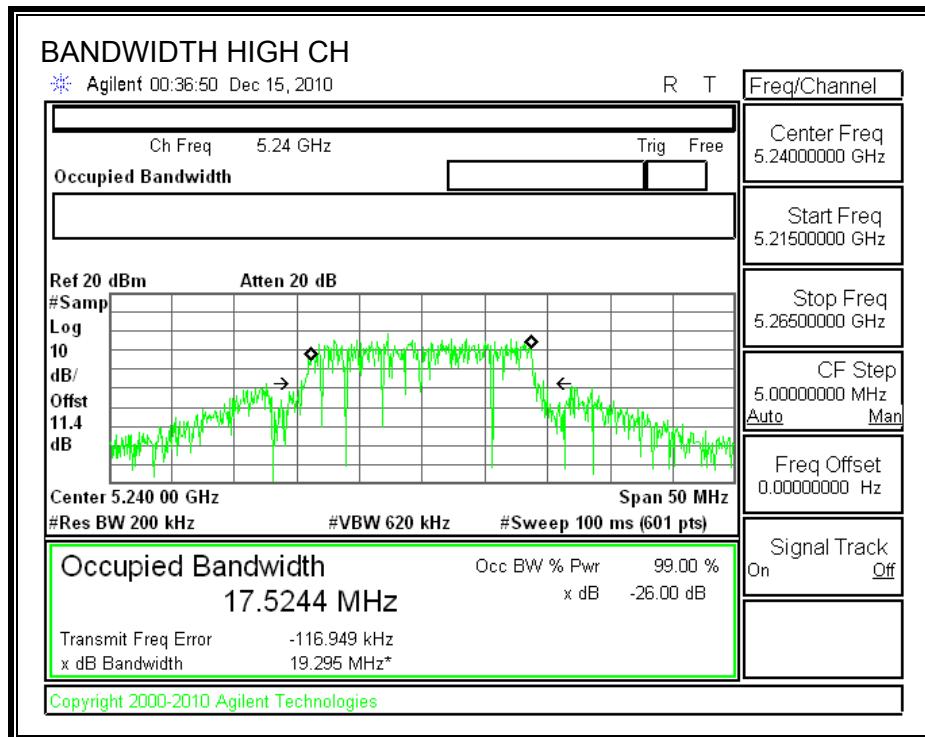
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.422	17.7168
Middle	5200	19.361	17.6554
High	5240	19.295	17.5244

26 dB and 99% BANDWIDTH





7.2.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

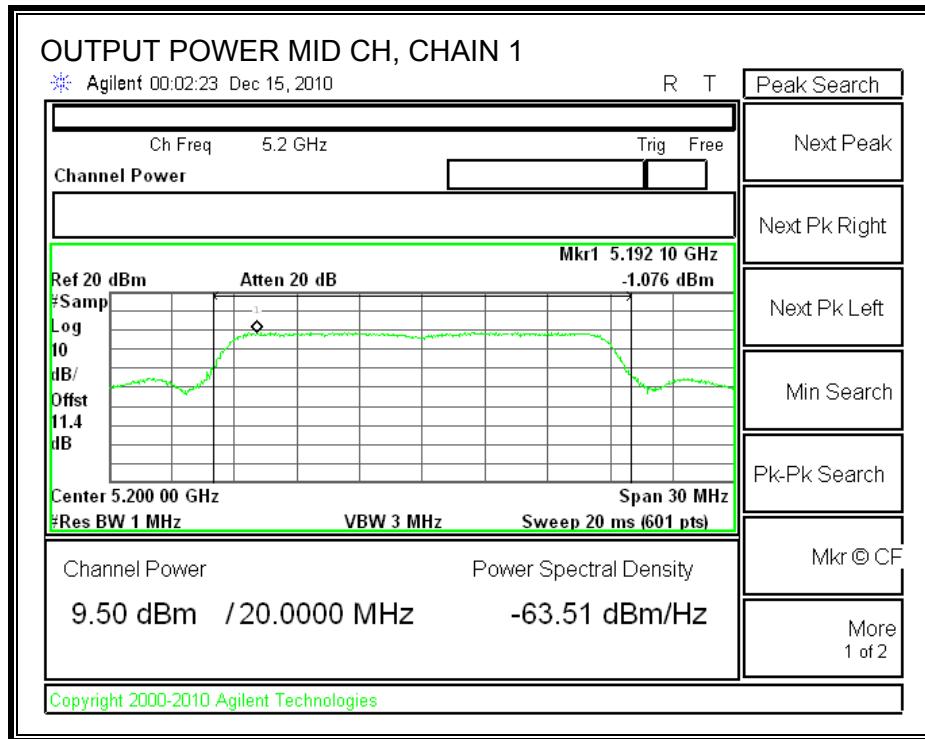
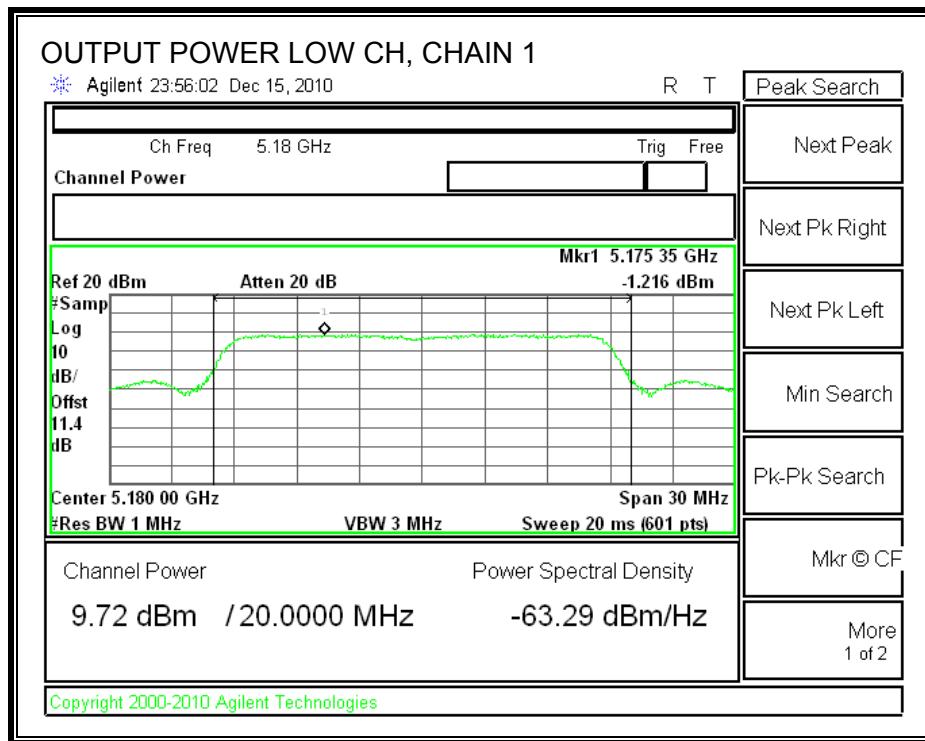
Limit

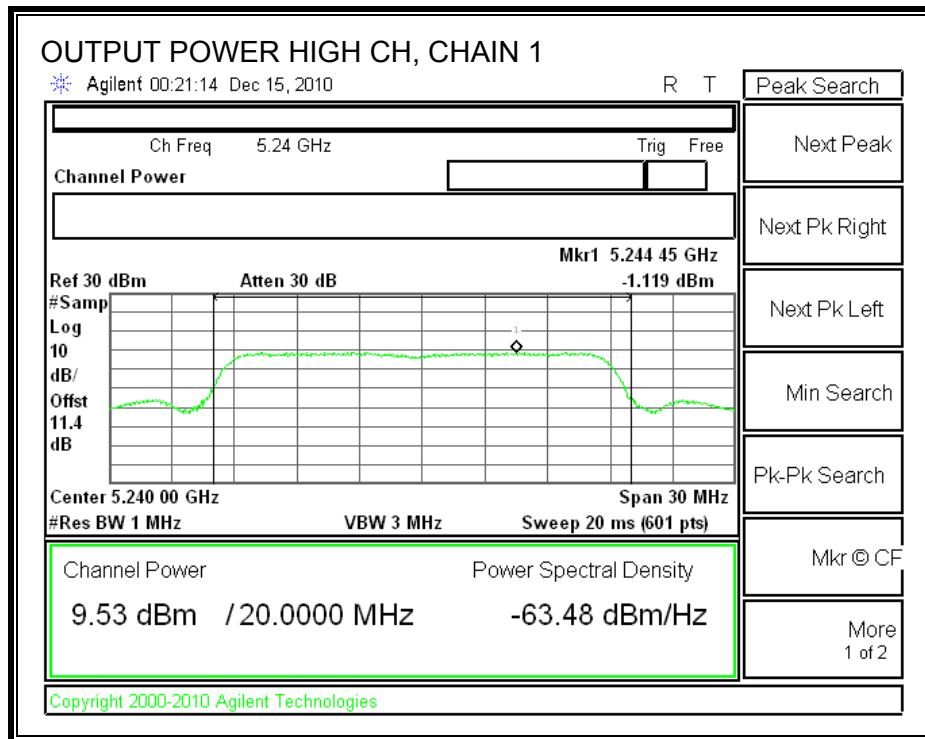
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.422	16.88	6.02	16.86
Mid	5200	16.99	19.361	16.87	6.02	16.85
High	5240	16.99	19.295	16.85	6.02	16.85

Individual Chain Results

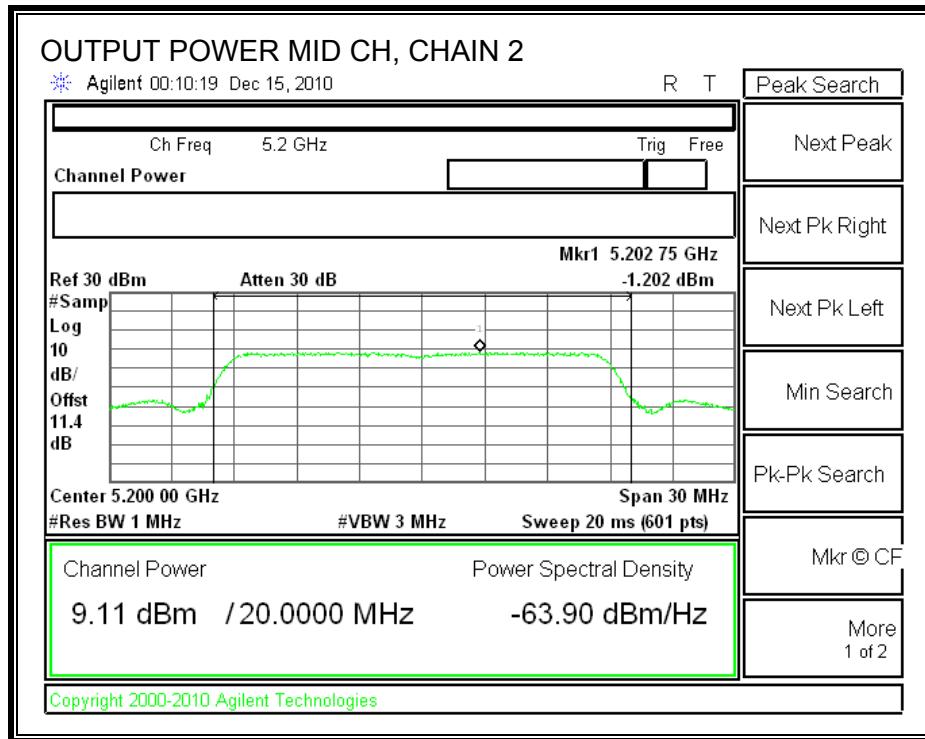
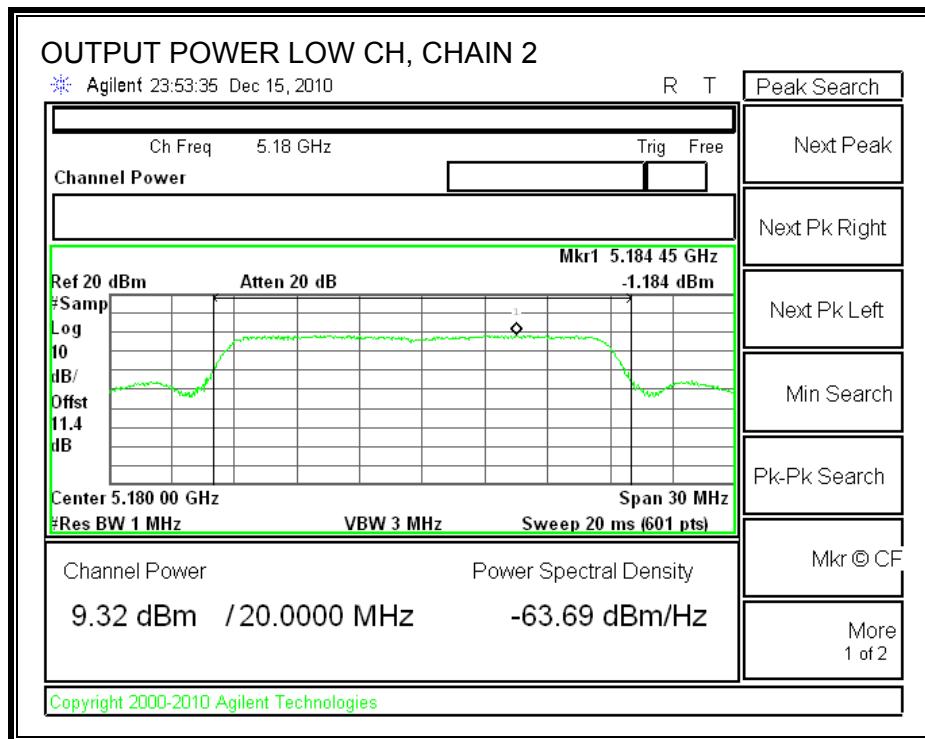
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	9.72	9.32	9.35	14.24	16.86	-2.62
Mid	5200	9.50	9.11	9.27	14.07	16.85	-2.78
High	5240	9.53	9.37	9.21	14.14	16.85	-2.71

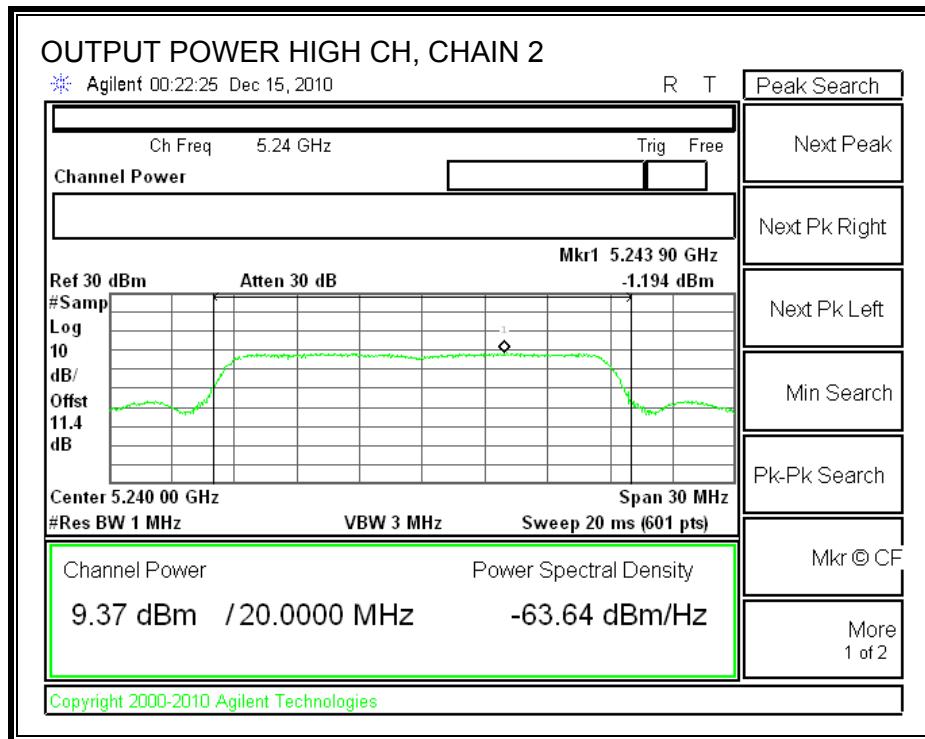
CHAIN 1 OUTPUT POWER



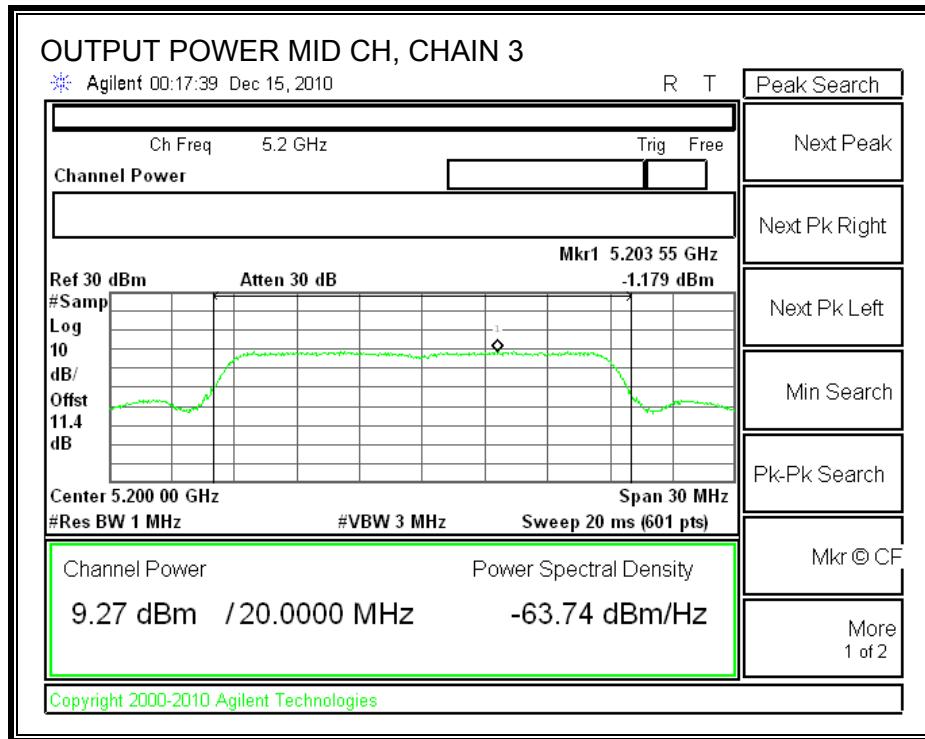
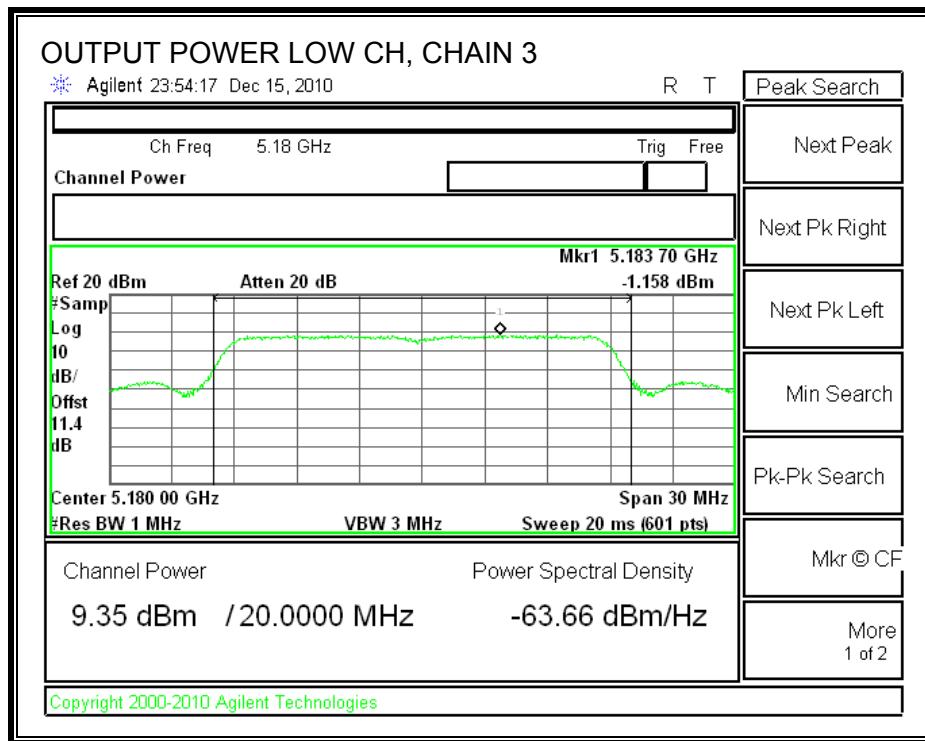


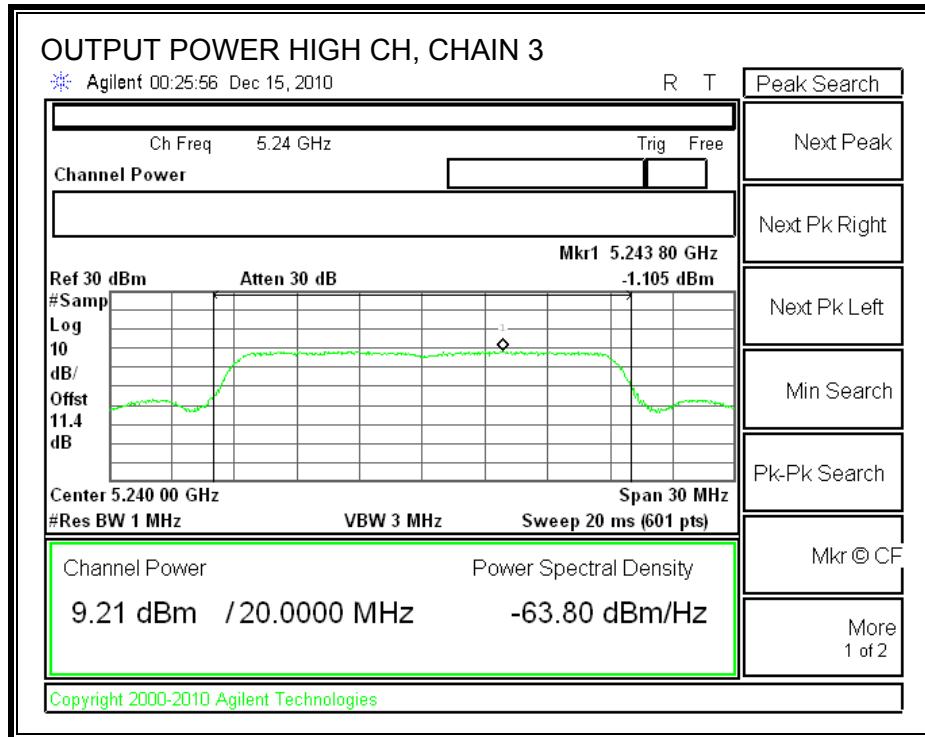
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.2.3. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

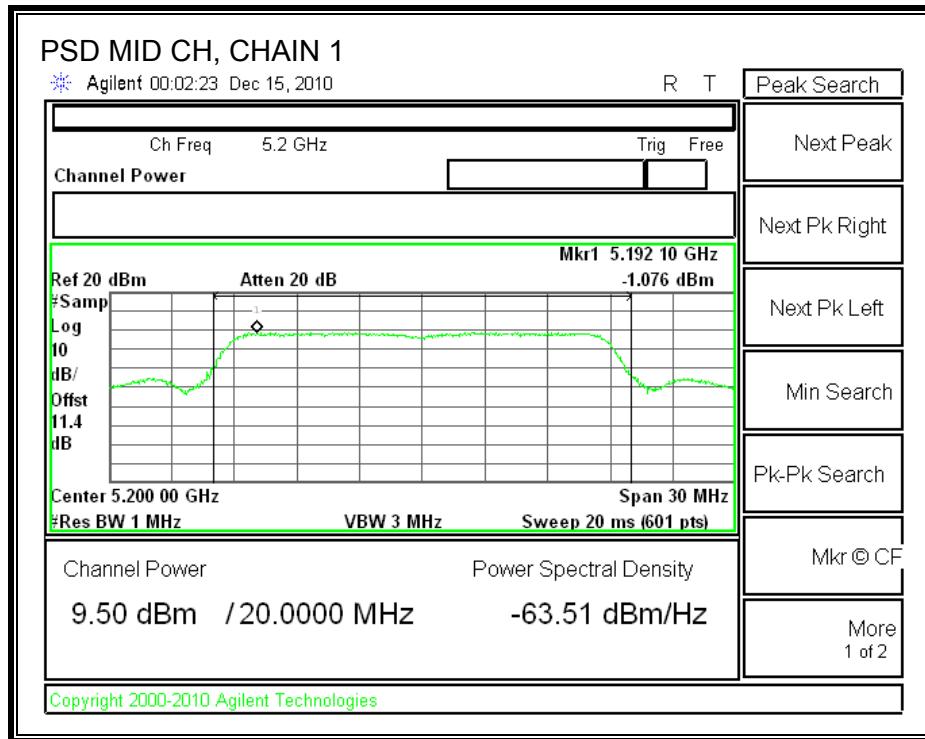
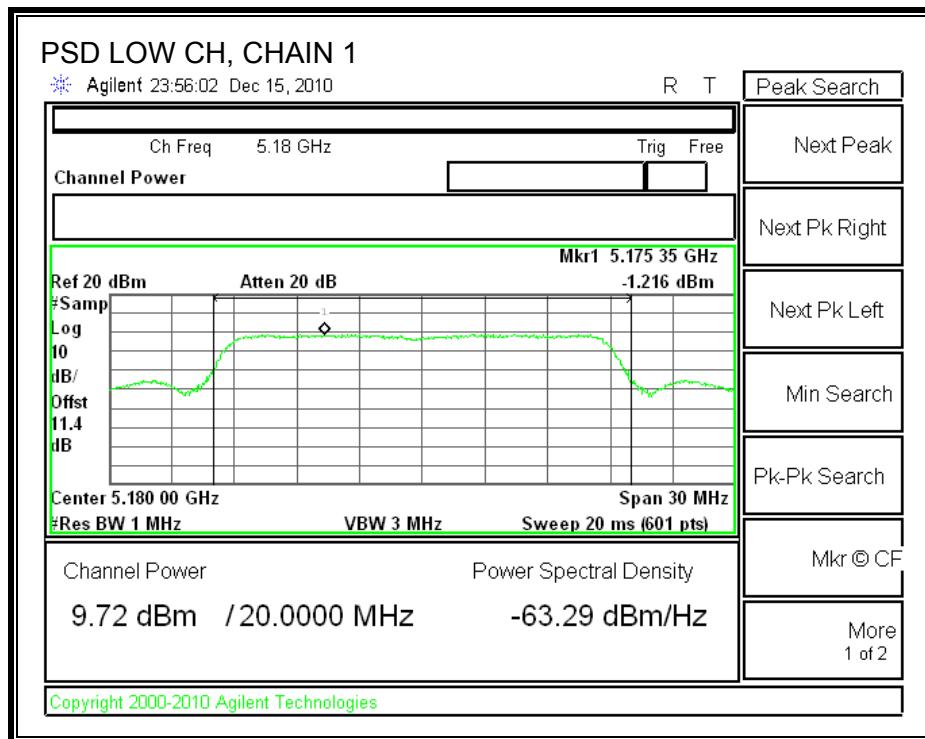
The max antenna gain is equal to 6.02 dBi, therefore the limit is 3.98 dBm.

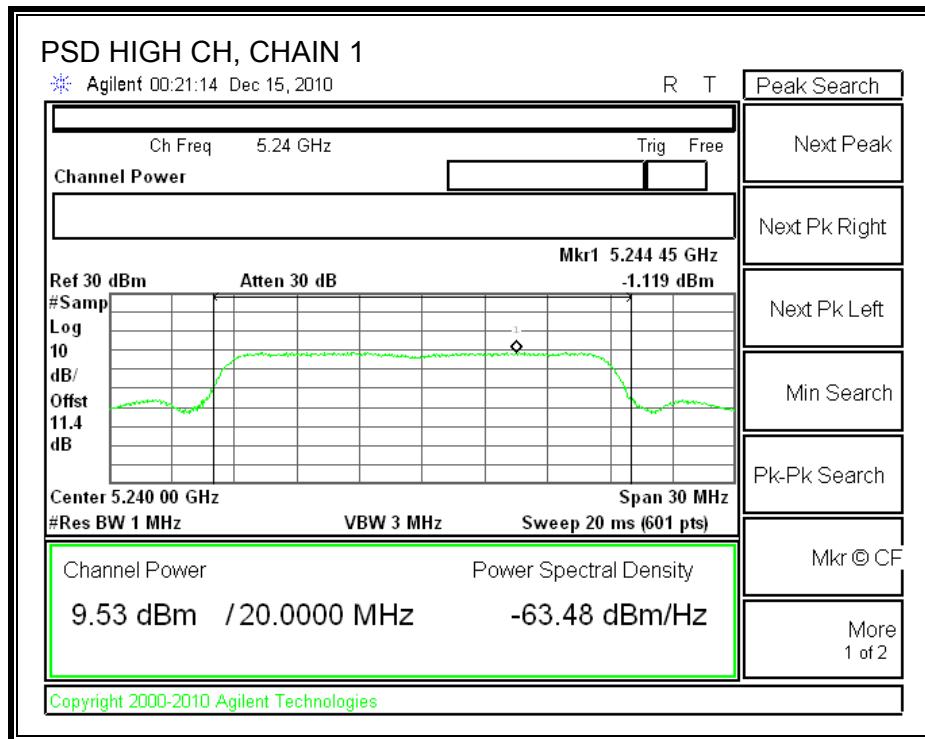
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

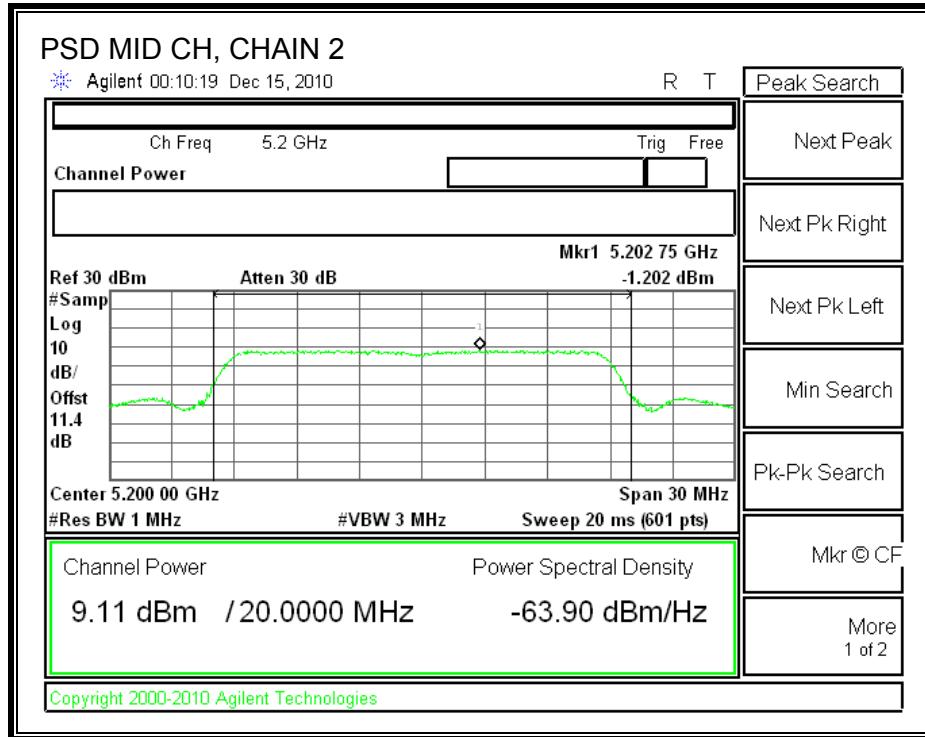
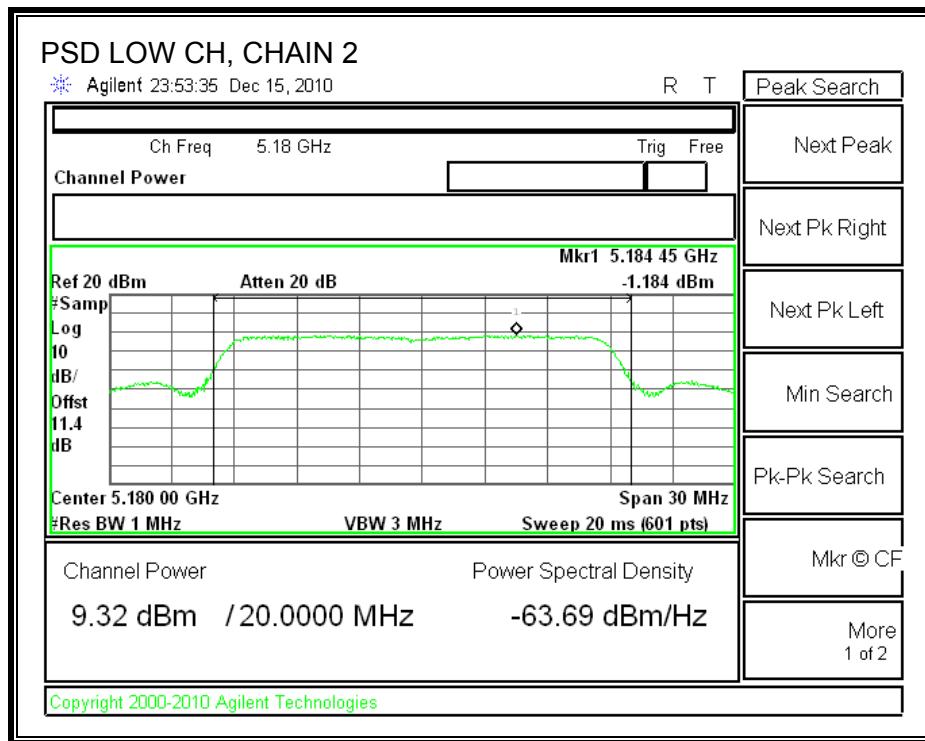
Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.216	-1.184	-1.158	3.59	3.98	-0.39
Middle	5200	-1.076	-1.202	-1.179	3.62	3.98	-0.36
High	5240	-1.119	-1.194	-1.105	3.63	3.98	-0.35

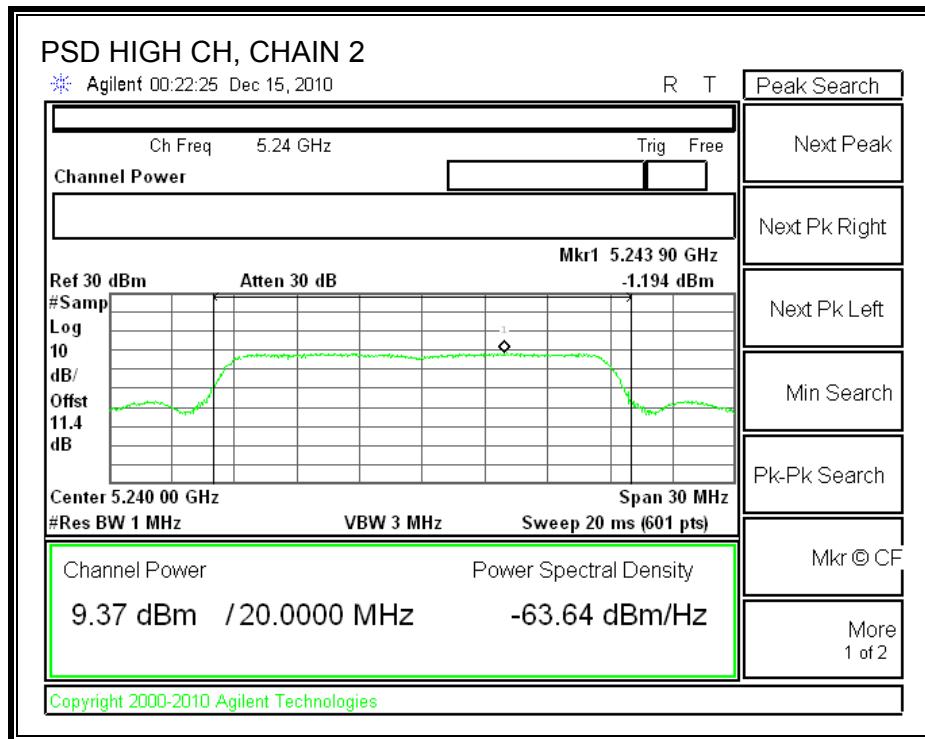
CHAIN 1 POWER SPECTRAL DENSITY



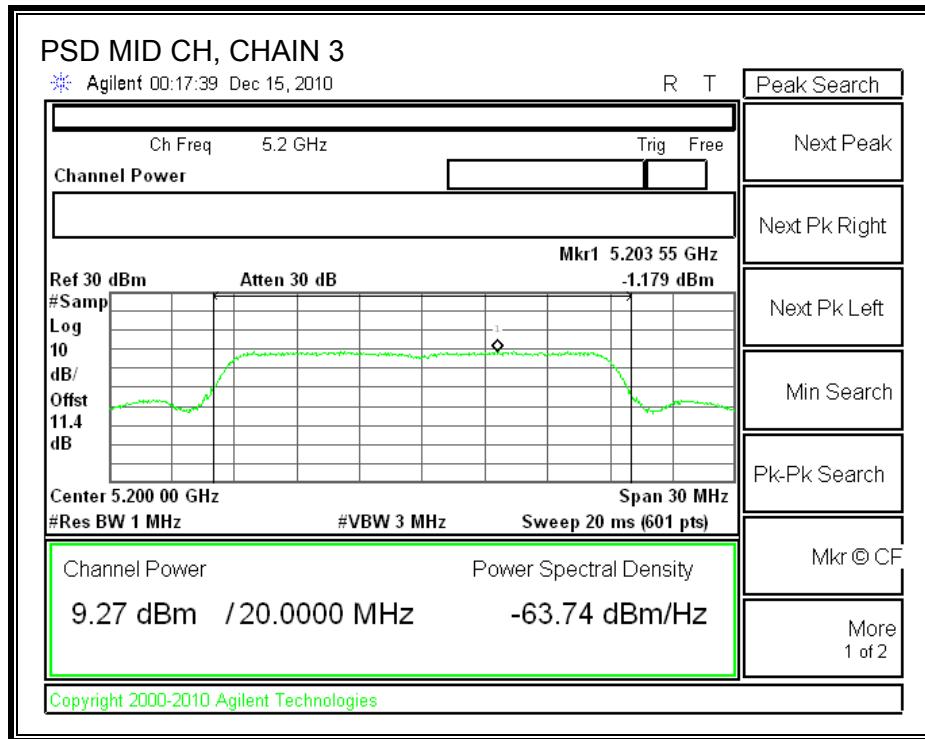
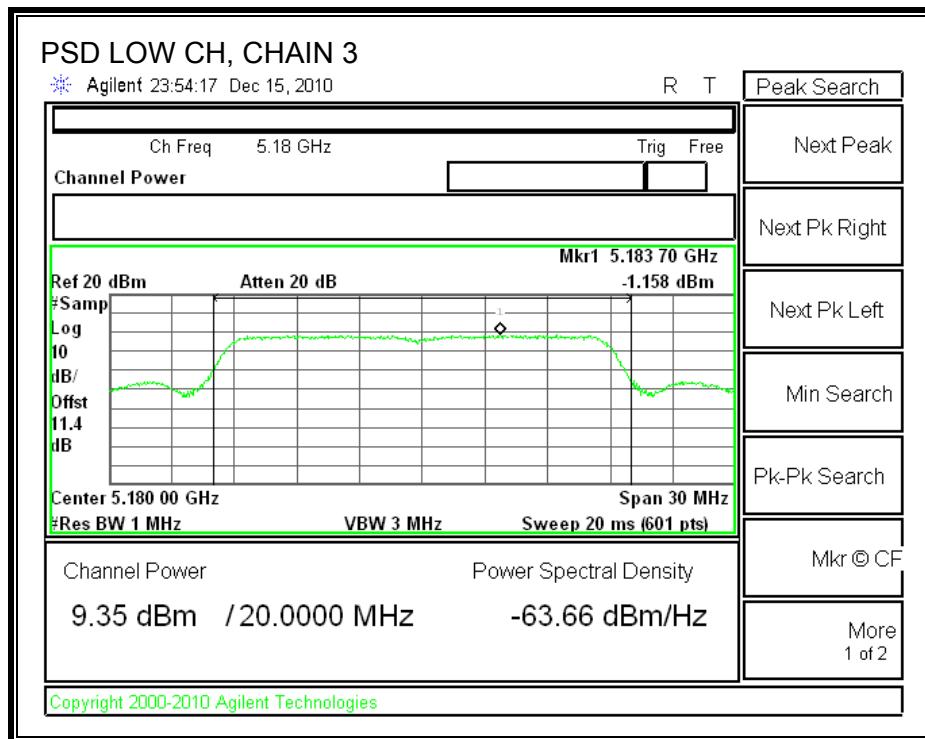


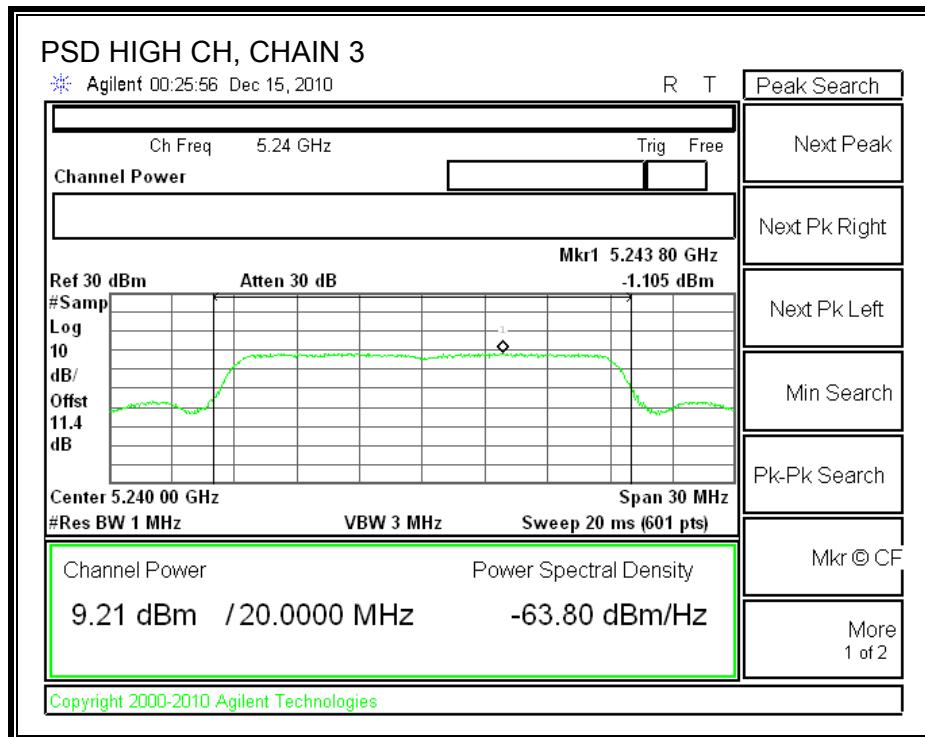
CHAIN 2 POWER SPECTRAL DENSITY





CHAIN 3 POWER SPECTRAL DENSITY





7.2.4. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

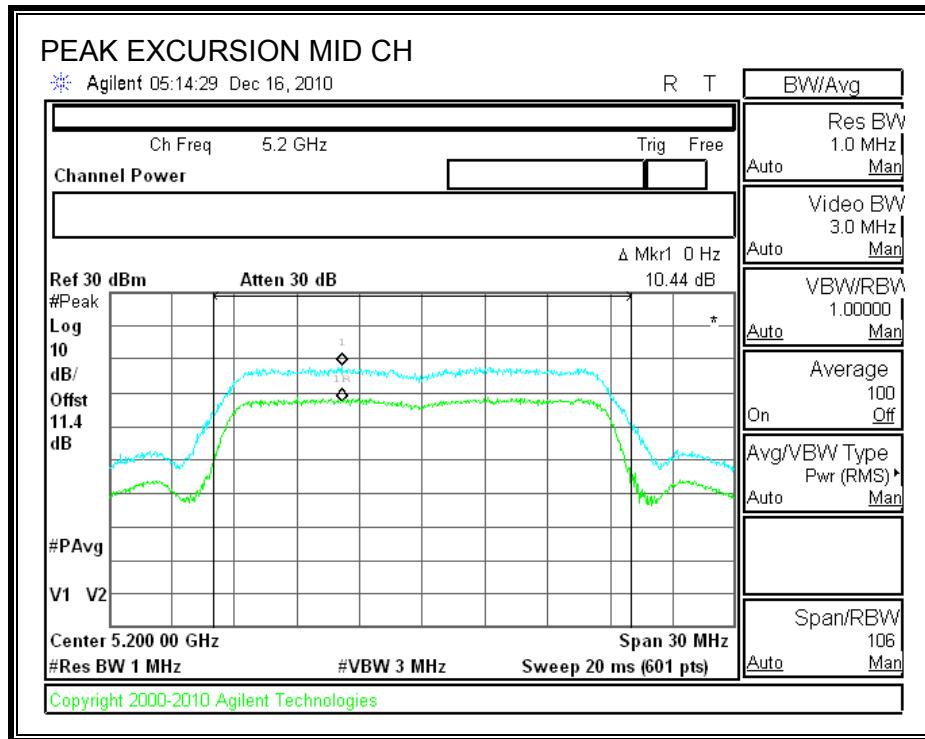
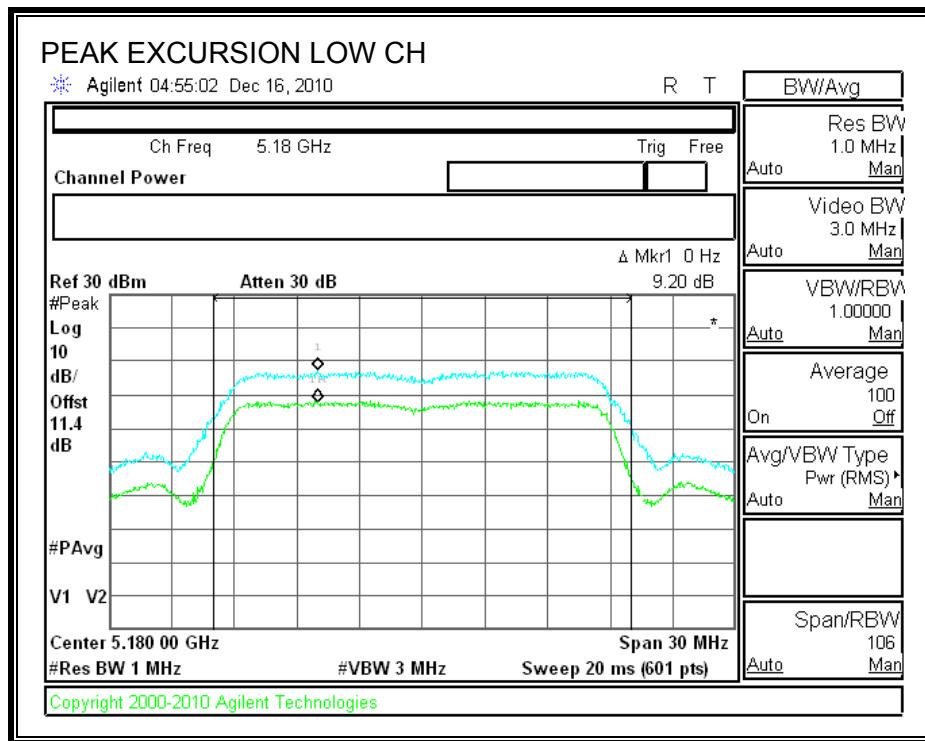
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

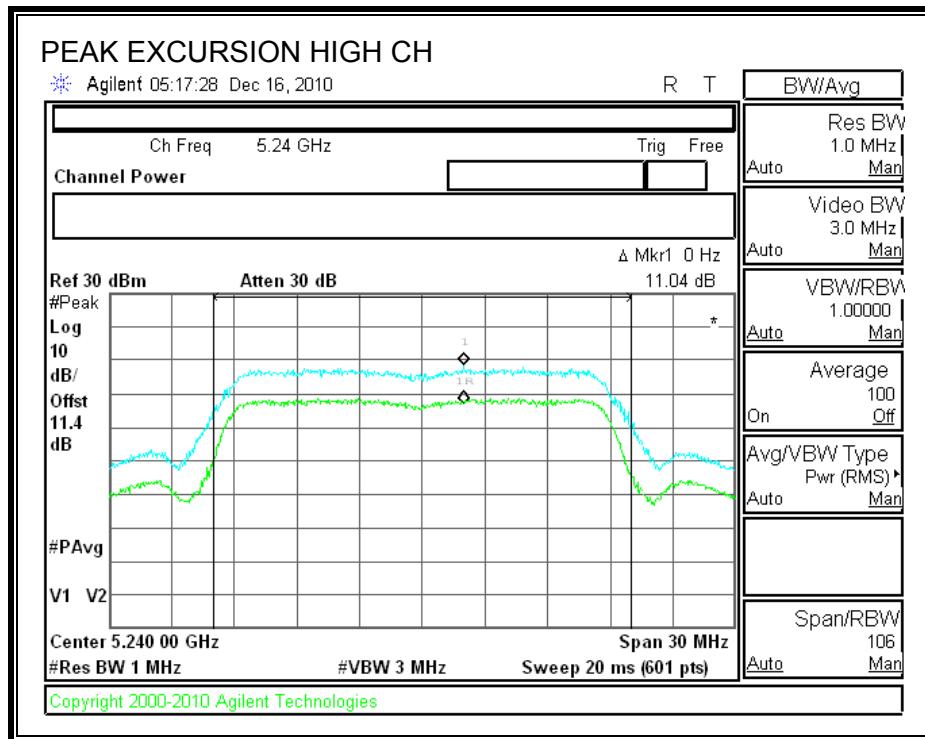
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.20	13	-3.80
Middle	5200	10.44	13	-2.56
High	5240	11.04	13	-1.96

PEAK EXCURSION





7.2.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

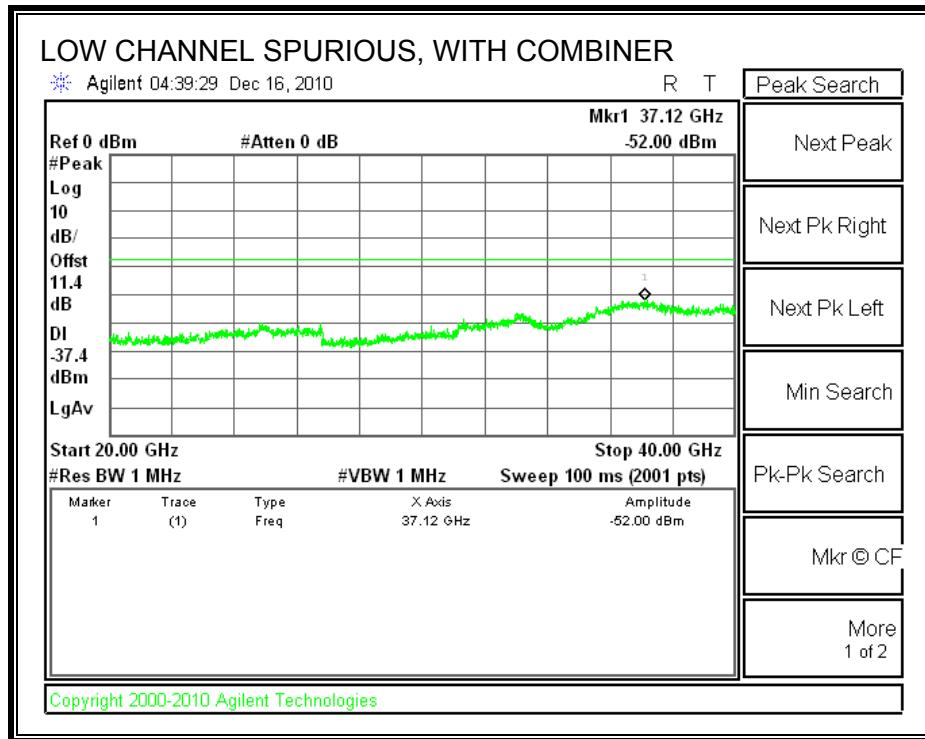
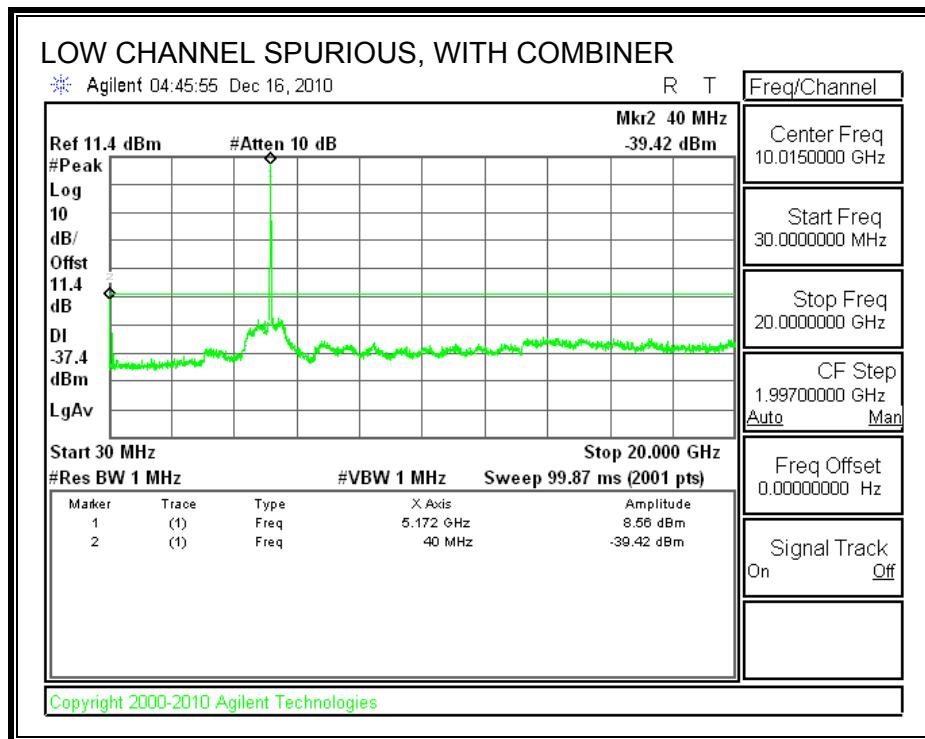
TEST PROCEDURE

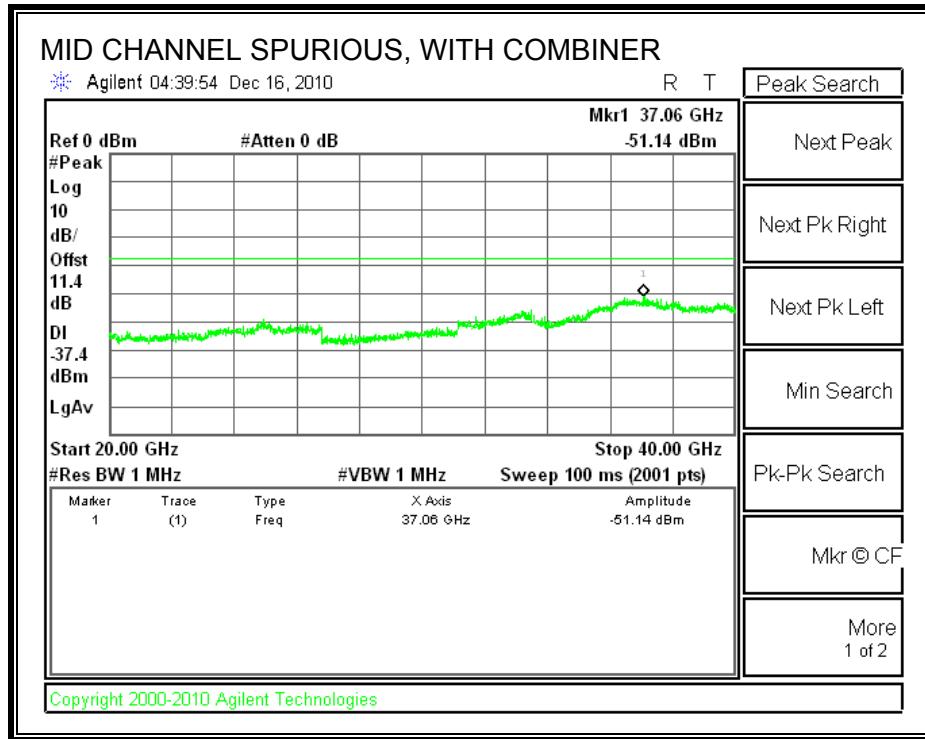
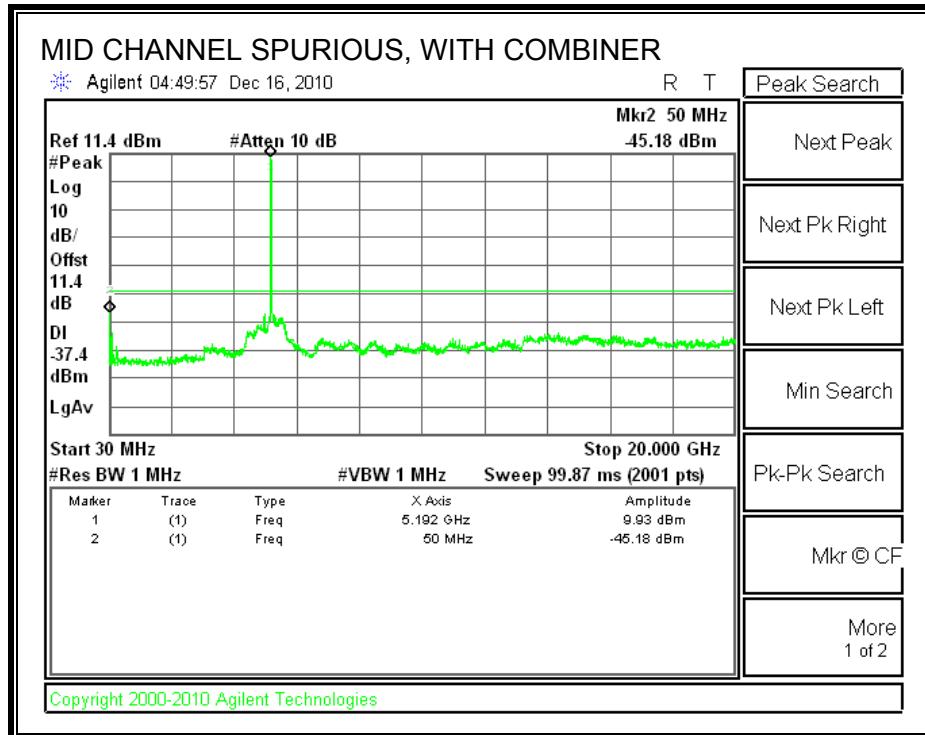
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

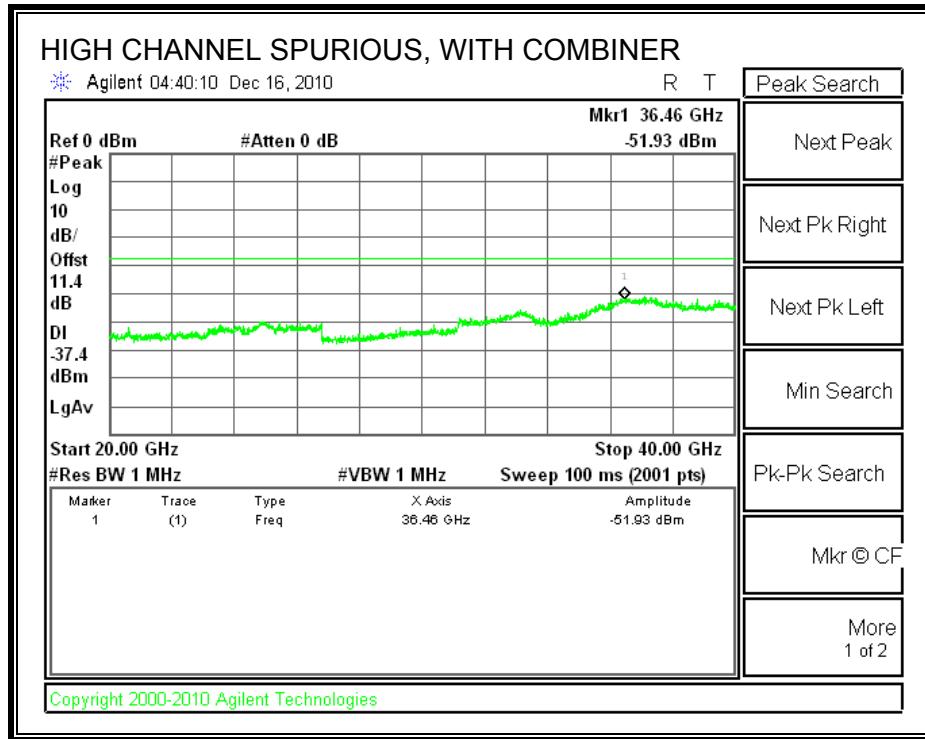
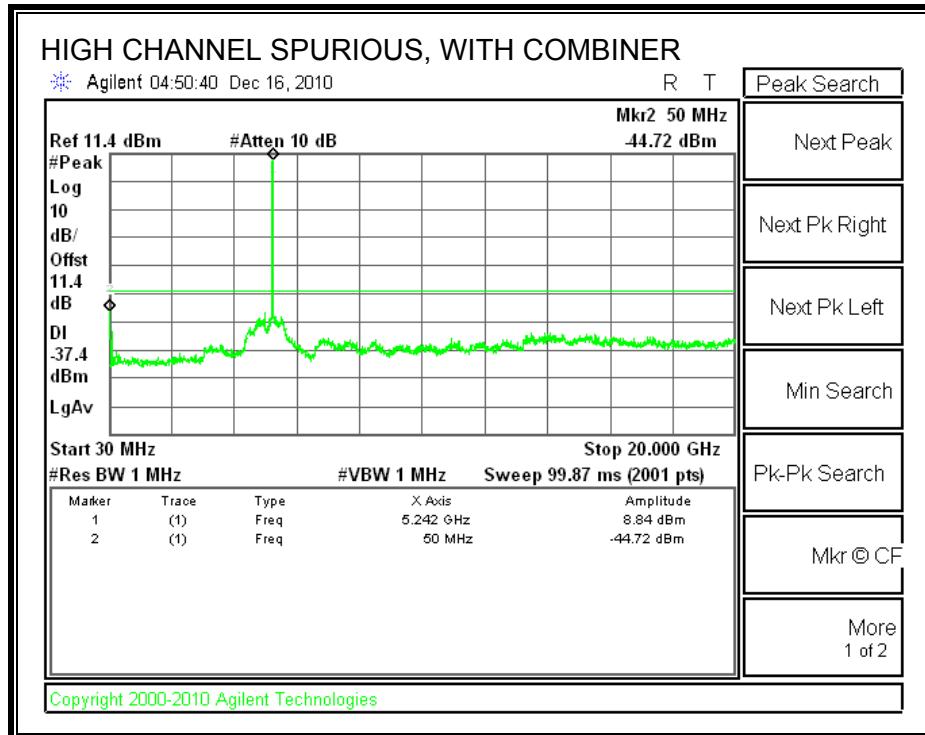
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER







SDM MCS8

7.2.6. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

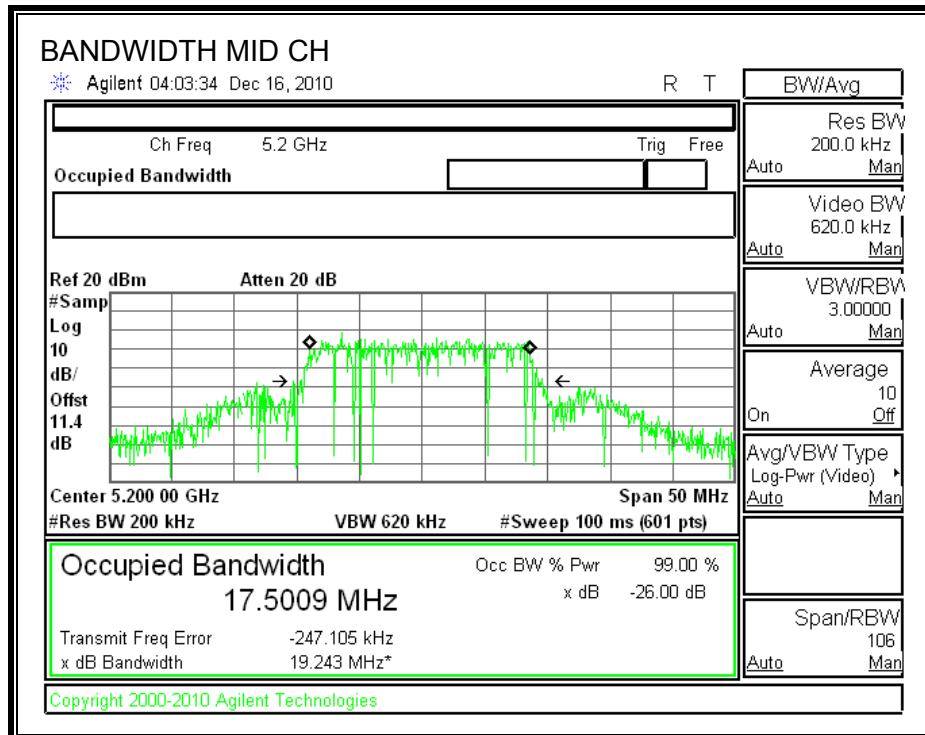
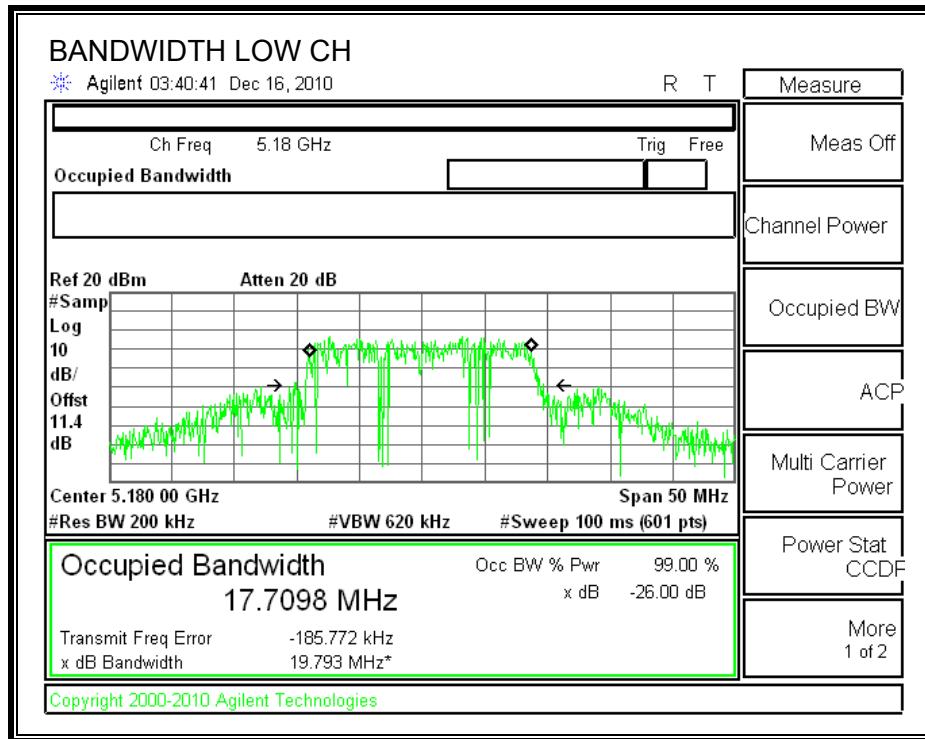
TEST PROCEDURE

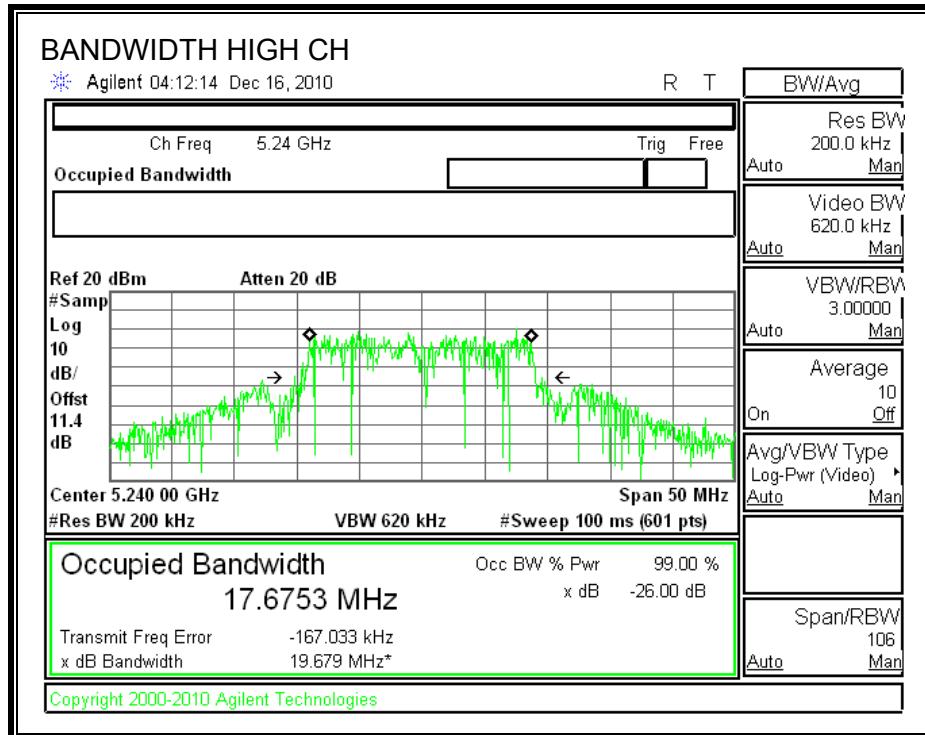
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.793	17.7098
Middle	5200	19.243	17.5009
High	5240	19.679	17.6753

26 dB and 99% BANDWIDTH





7.2.7. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.793	16.97	6.02	16.95
Mid	5200	16.99	19.243	16.84	6.02	16.82
High	5240	16.99	19.679	16.94	6.02	16.94

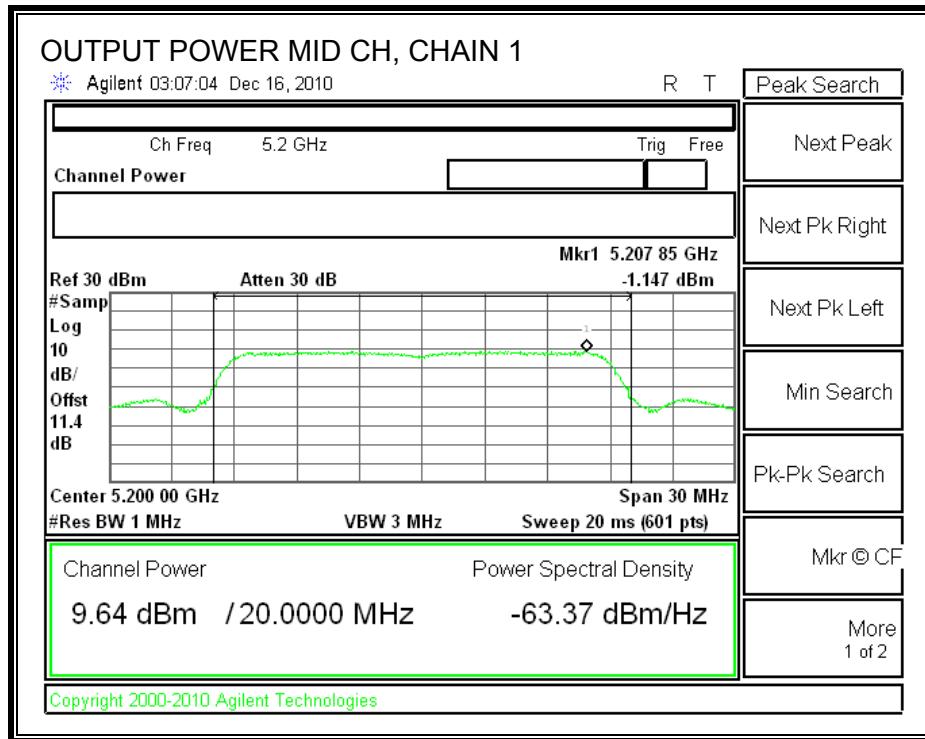
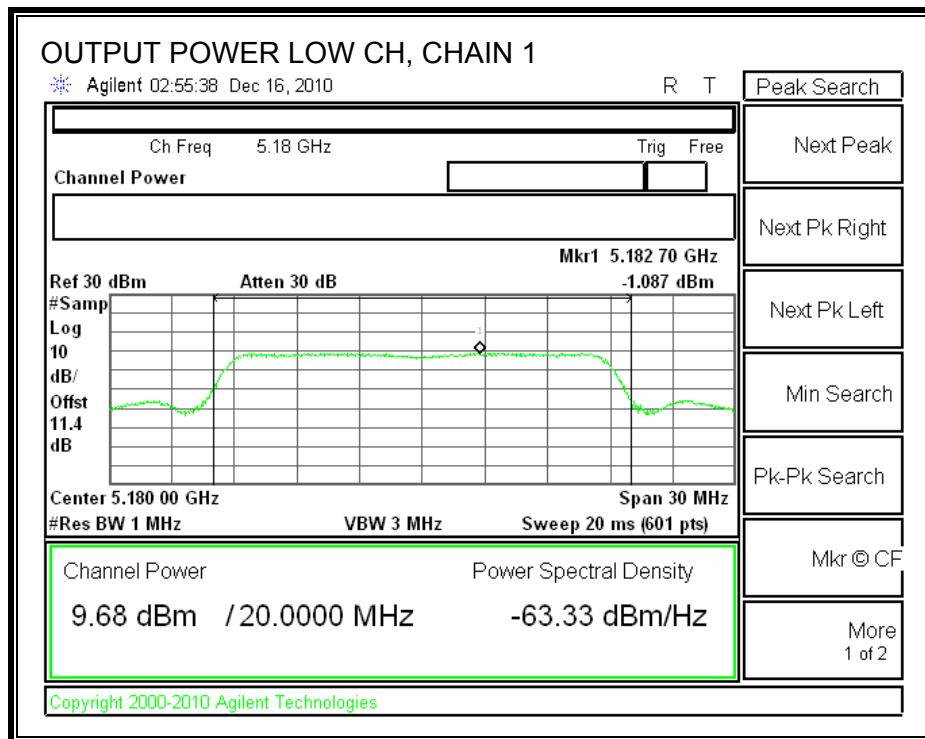
Individual Chain Results

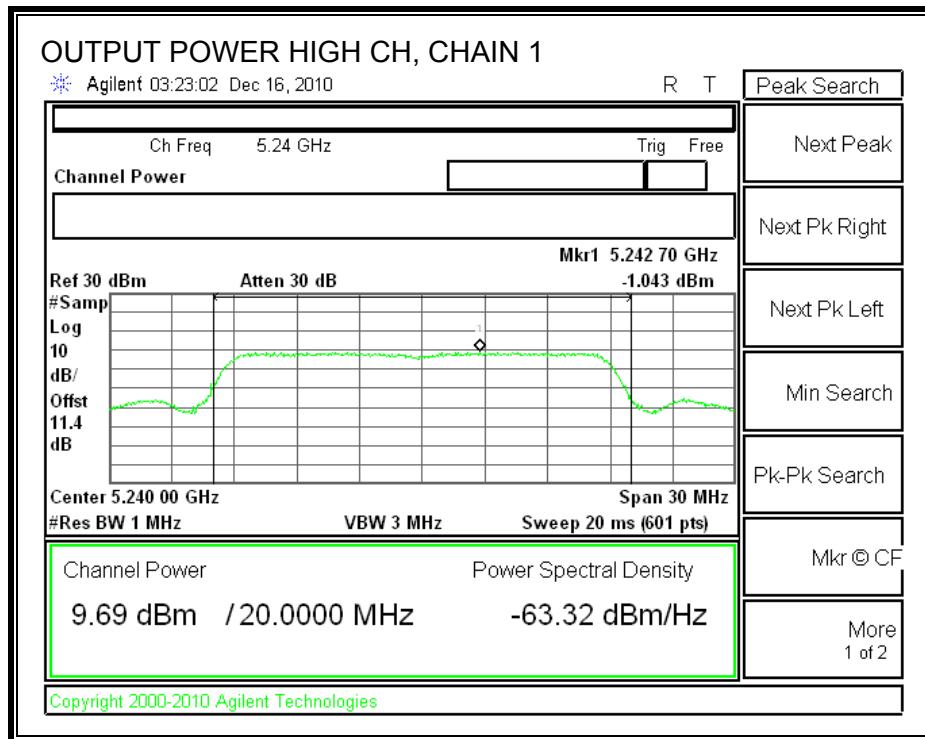
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	9.68	9.59	9.22	14.27	16.95	-2.67
Mid	5200	9.64	9.56	9.16	14.23	16.82	-2.59
High	5240	9.69	9.48	9.46	14.32	16.94	-2.62

The transmitter output operates continuously therefore Method # 1 is used.

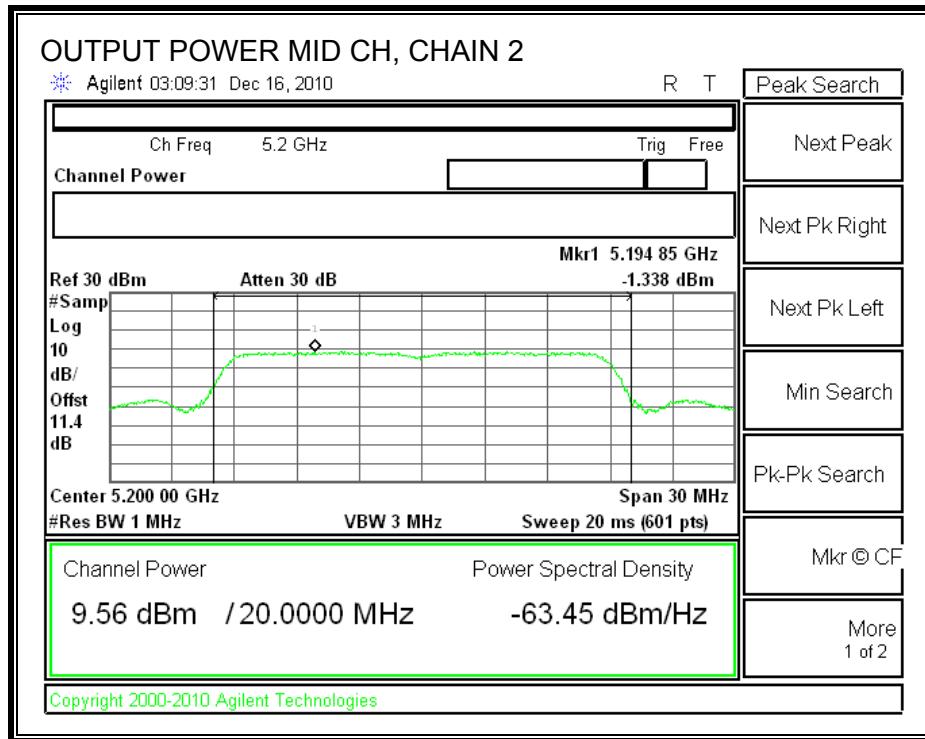
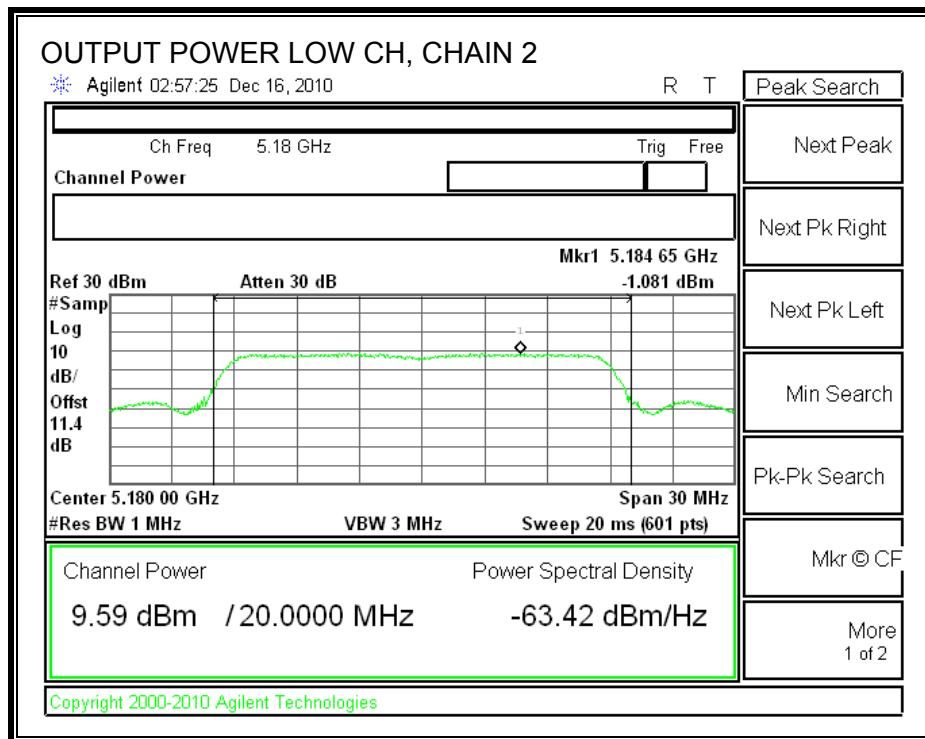
RESULTS

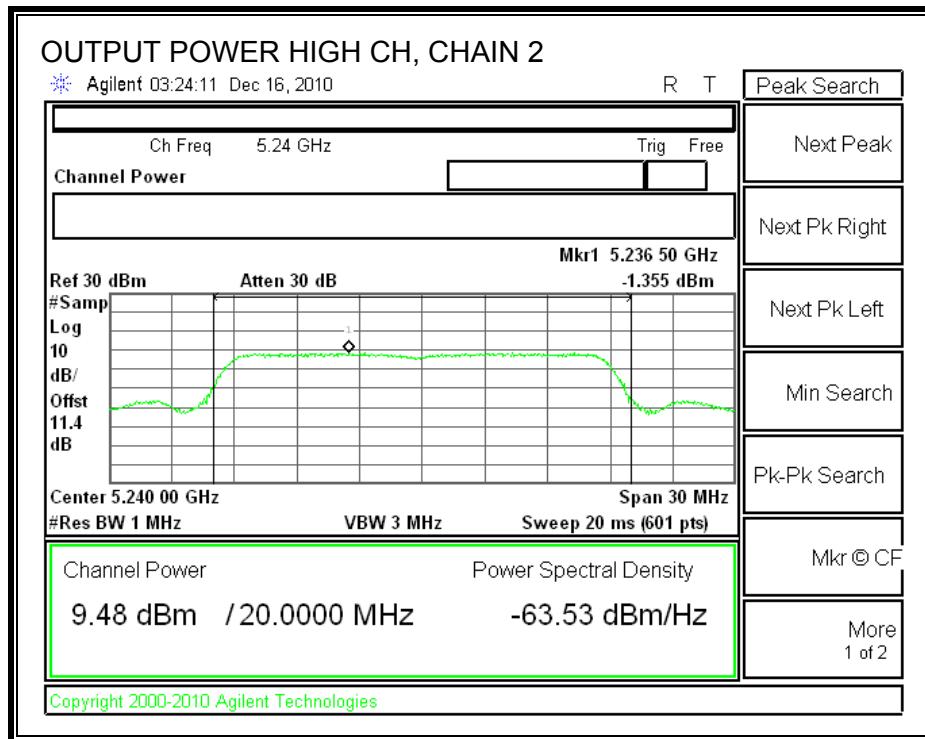
CHAIN 1 OUTPUT POWER



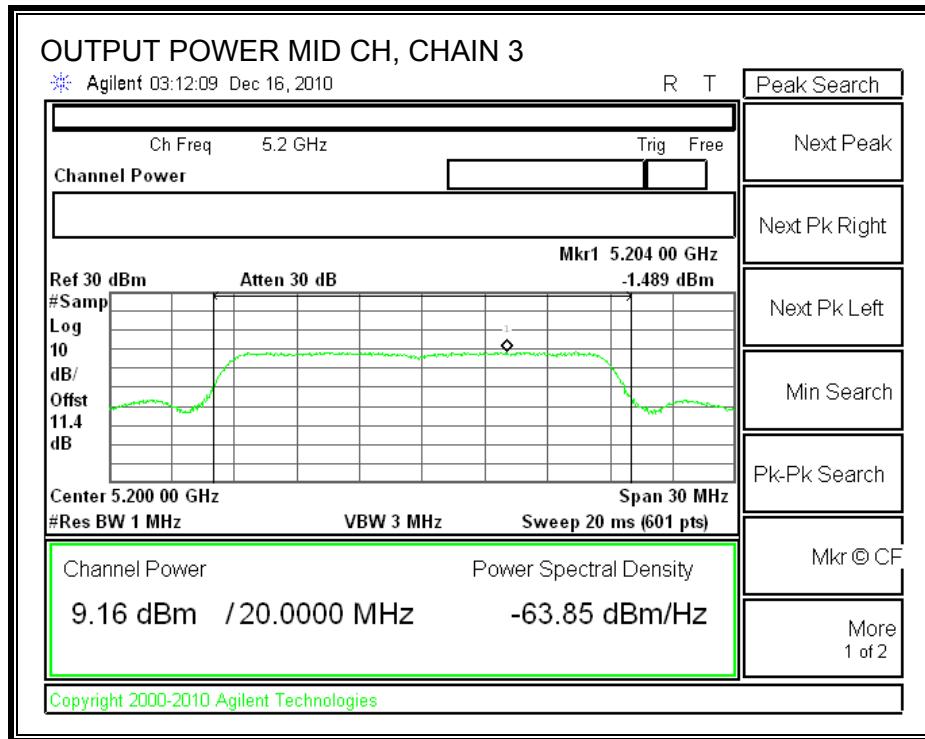
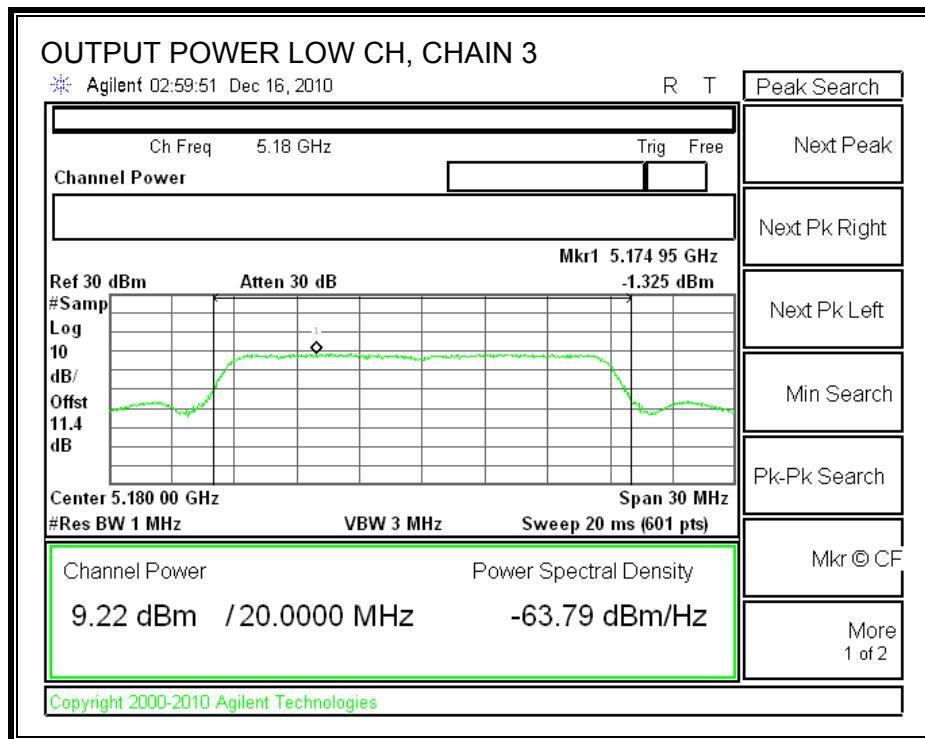


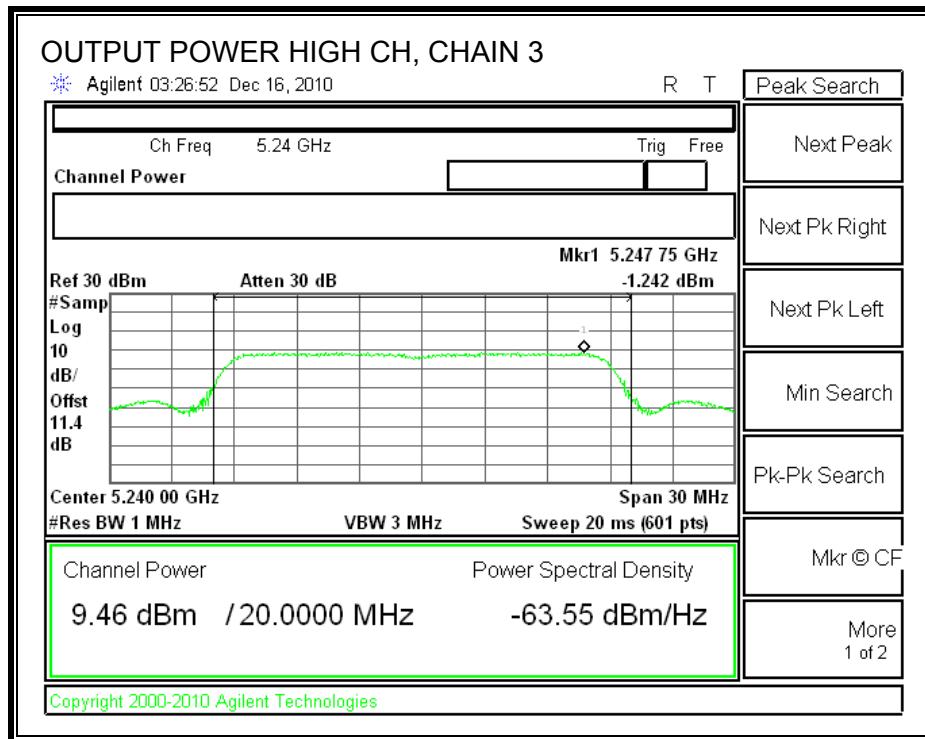
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.2.8. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is equal to 6.02 dBi, therefore the limit is 3.98 dBm.

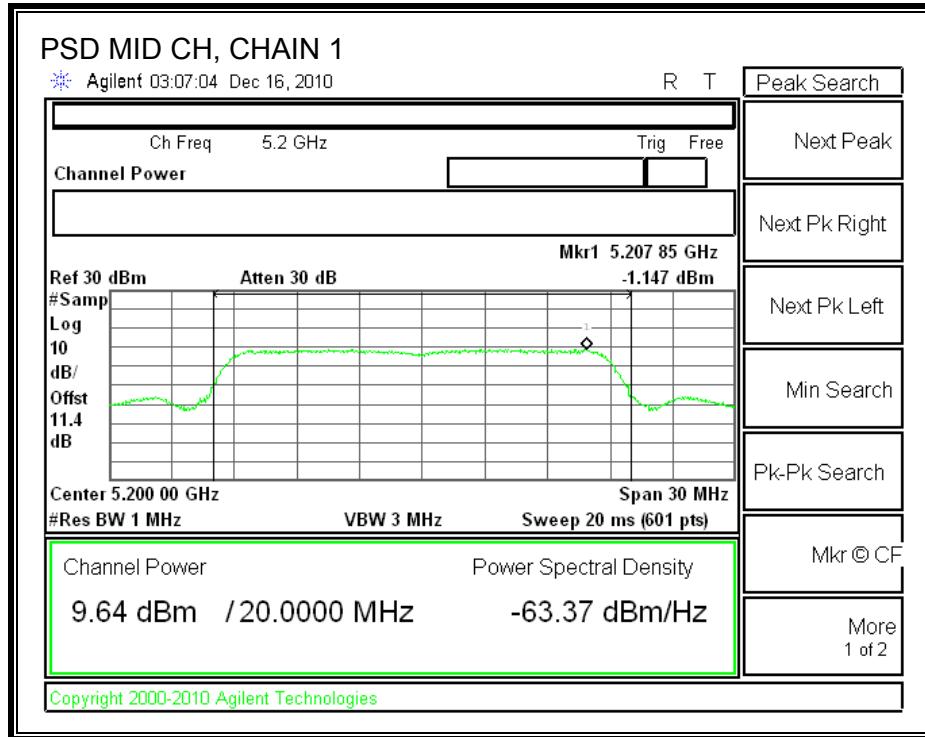
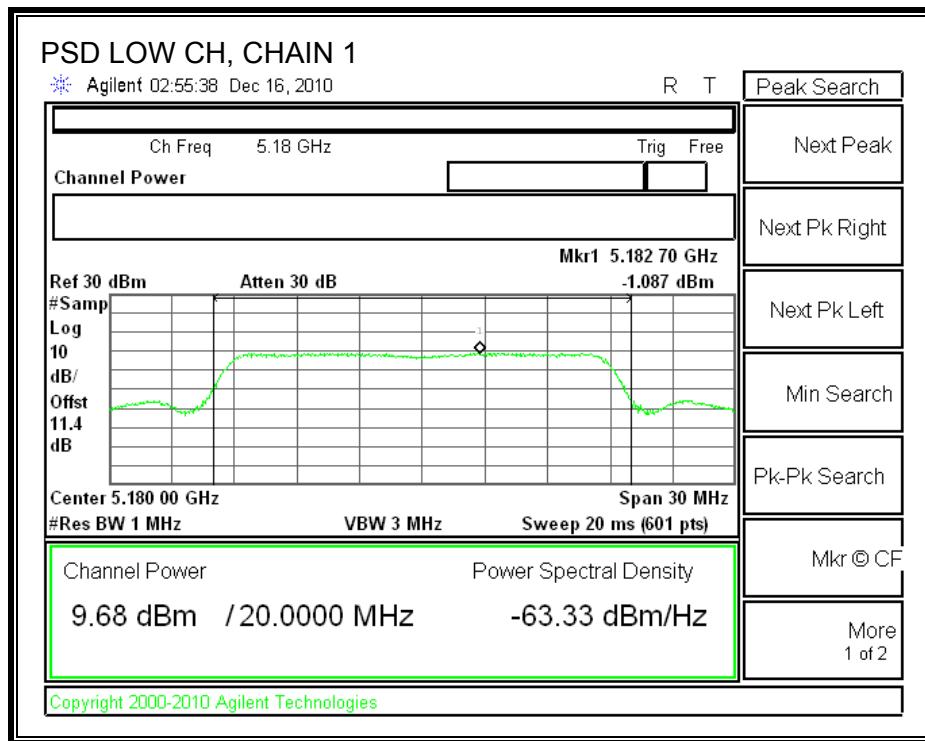
TEST PROCEDURE

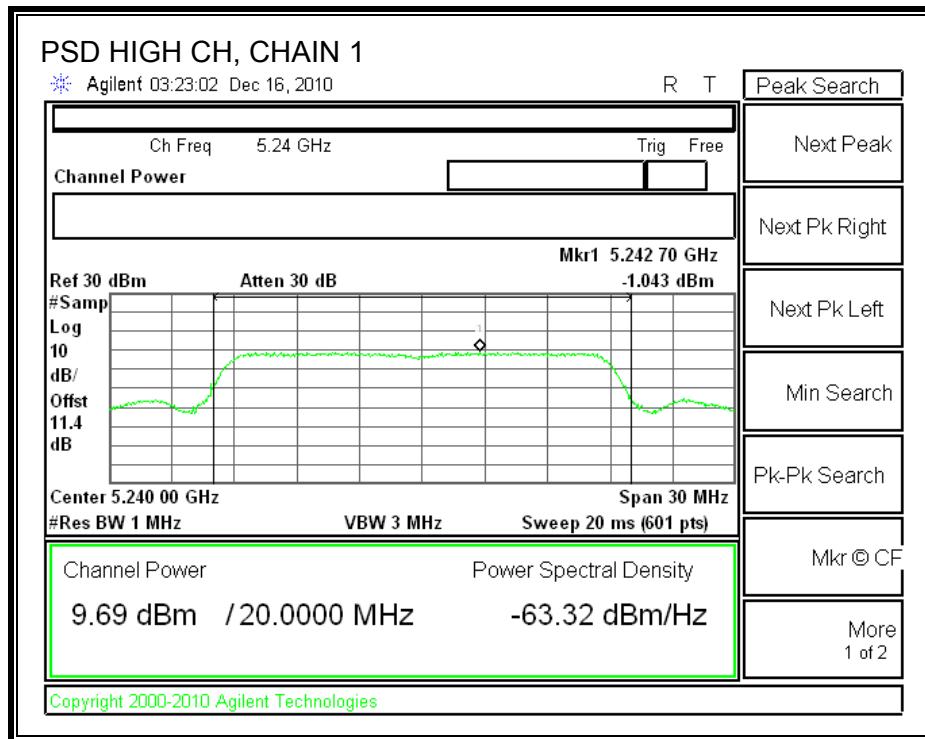
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

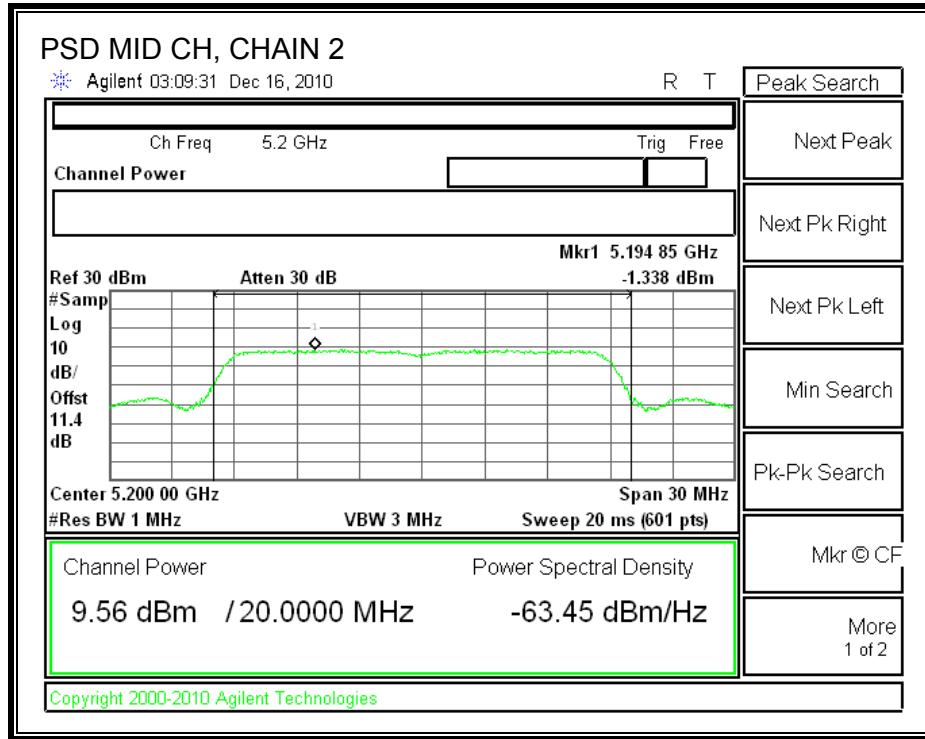
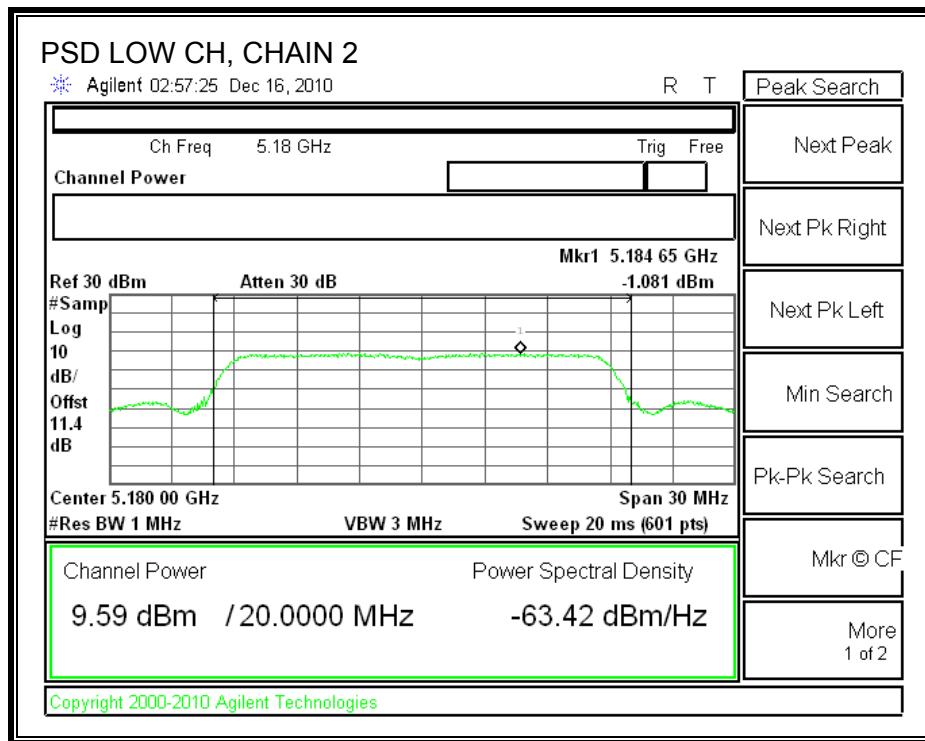
Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.087	-1.081	-1.325	3.61	3.98	-0.37
Middle	5200	-1.147	-1.338	-1.489	3.45	3.98	-0.53
High	5240	-1.043	-1.355	-1.242	3.56	3.98	-0.42

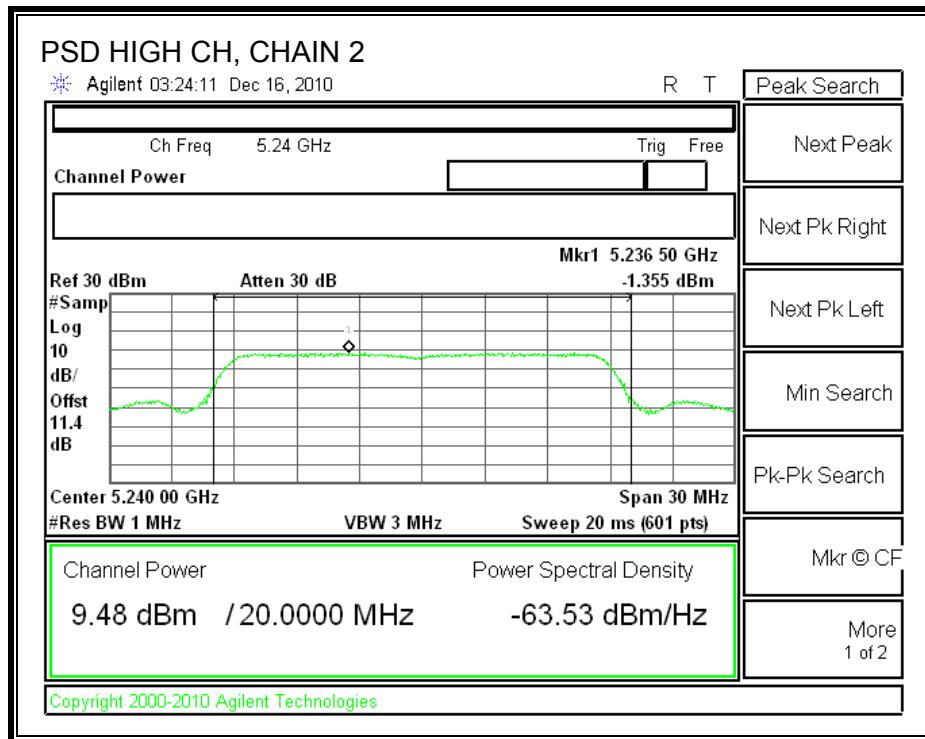
CHAIN 1 POWER SPECTRAL DENSITY



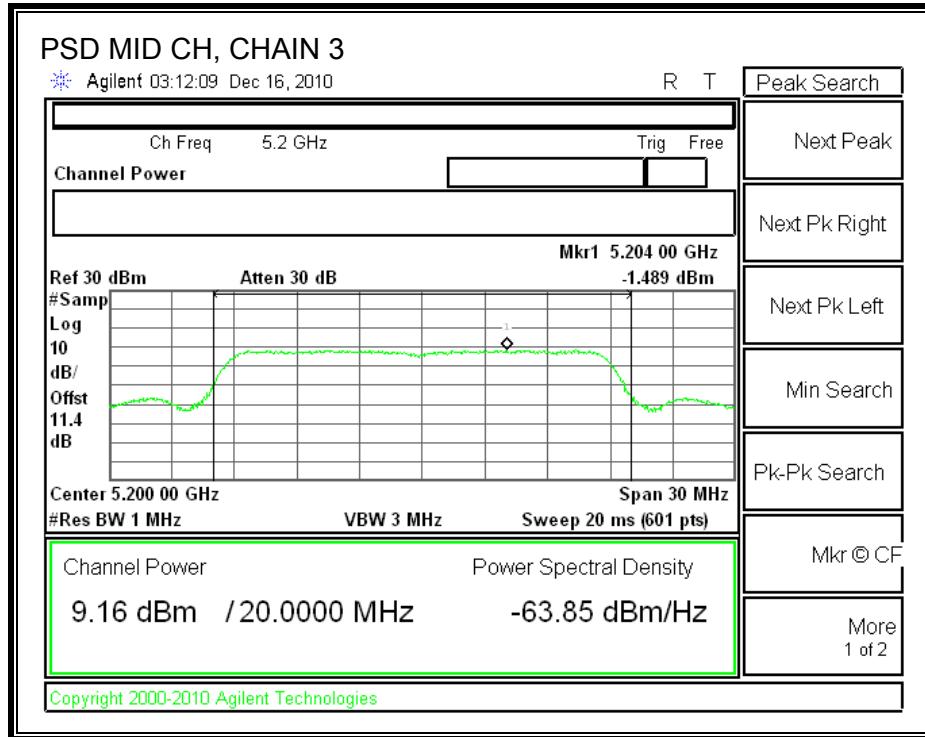
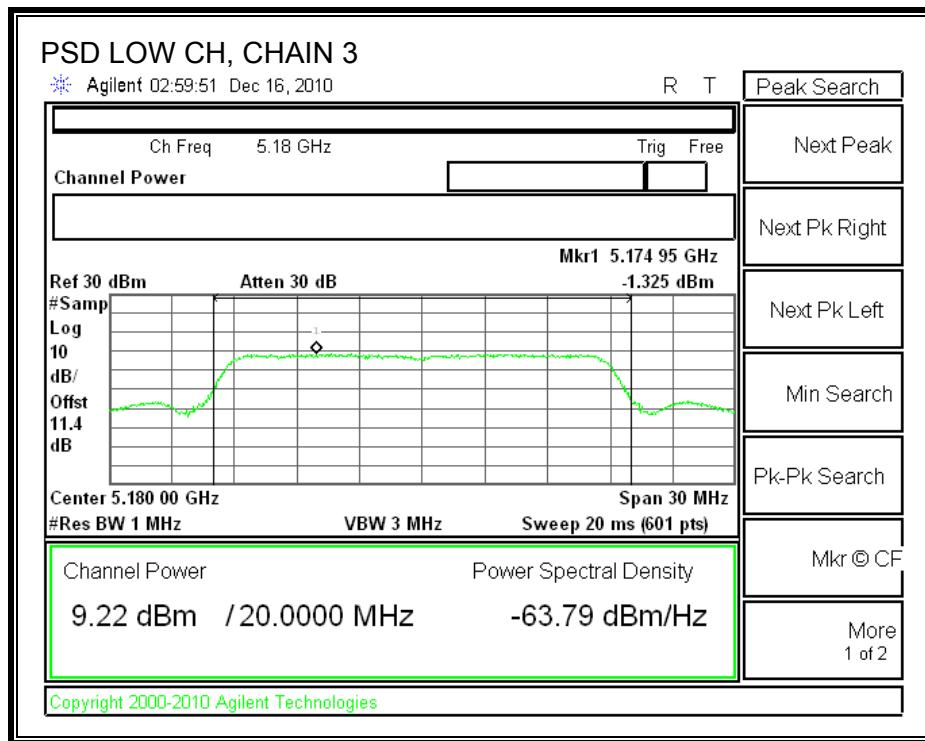


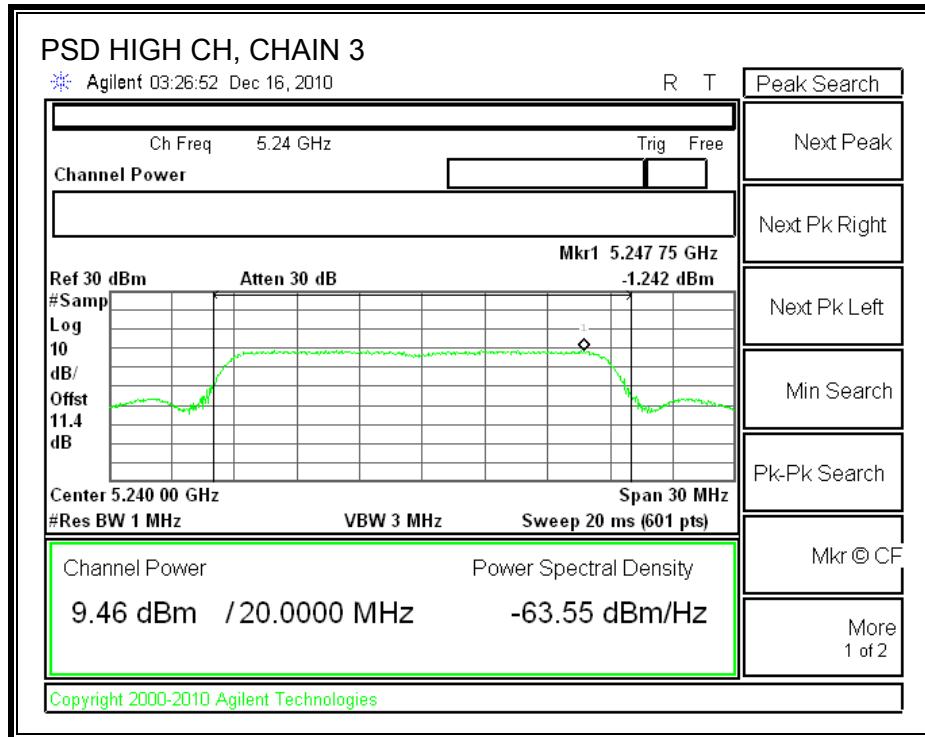
CHAIN 2 POWER SPECTRAL DENSITY





CHAIN 3 POWER SPECTRAL DENSITY





7.2.9. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

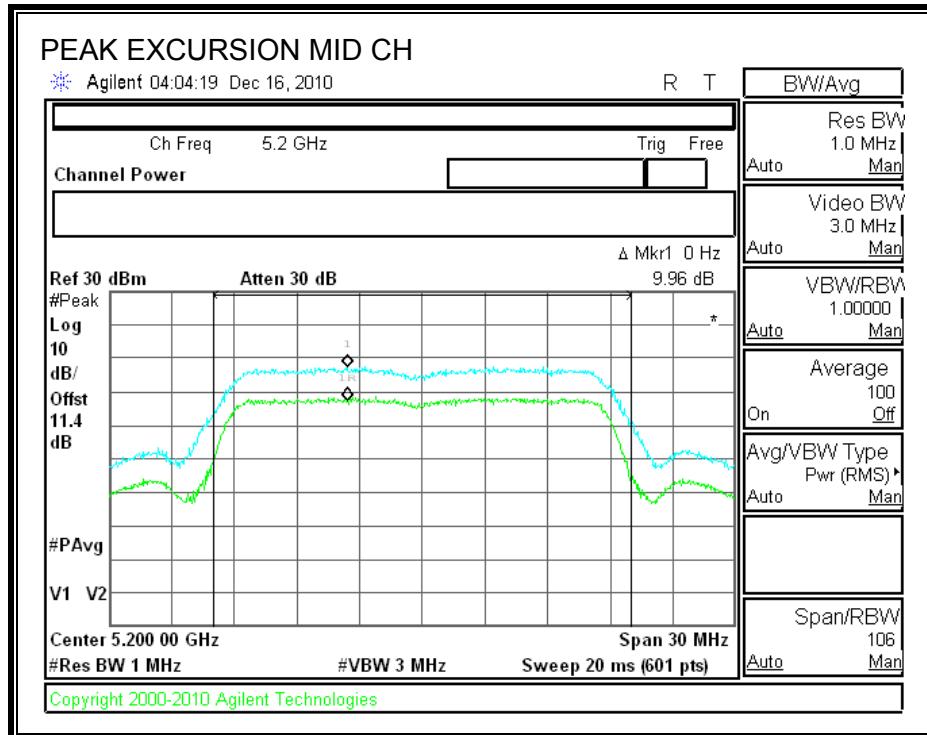
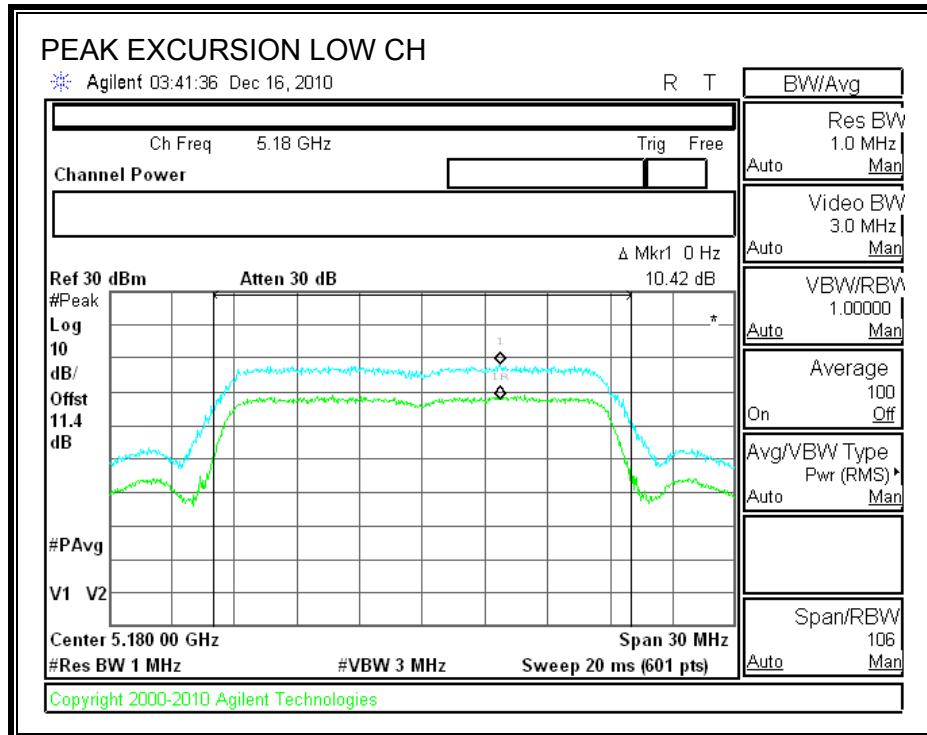
The transmitter outputs are connected to the spectrum analyzer via a combiner.

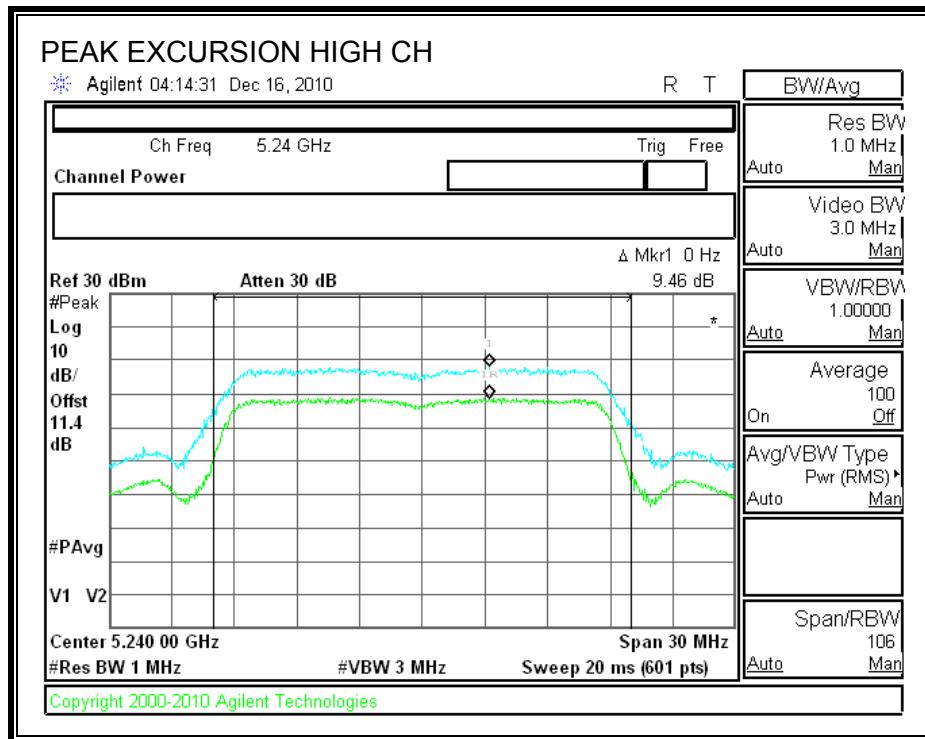
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	10.42	13	-2.58
Middle	5200	9.96	13	-3.04
High	5240	9.46	13	-3.54





7.2.10. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

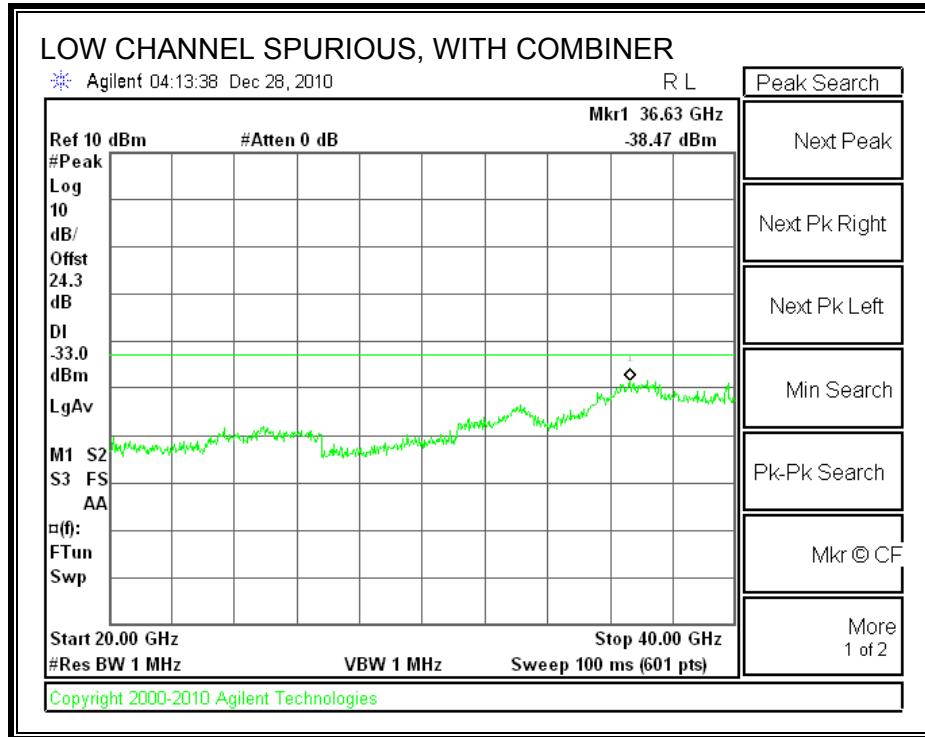
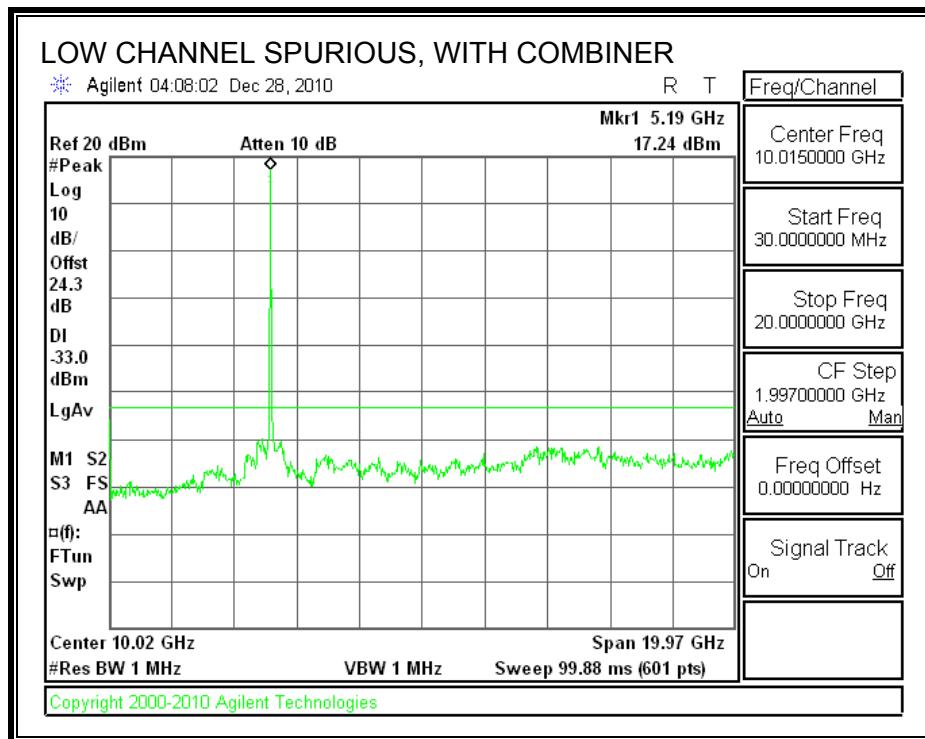
TEST PROCEDURE

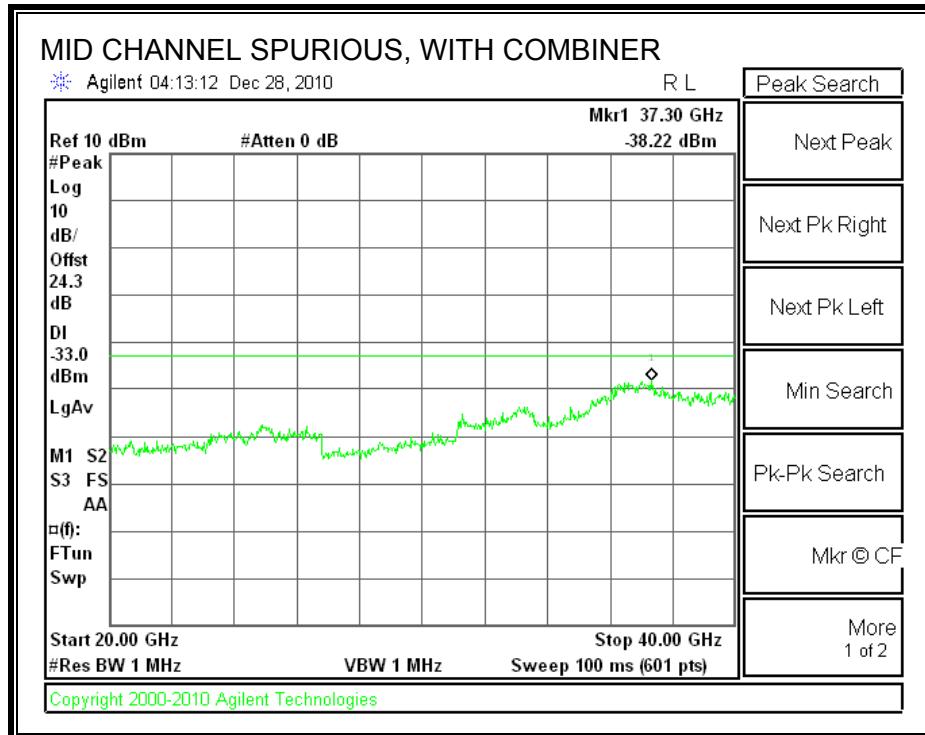
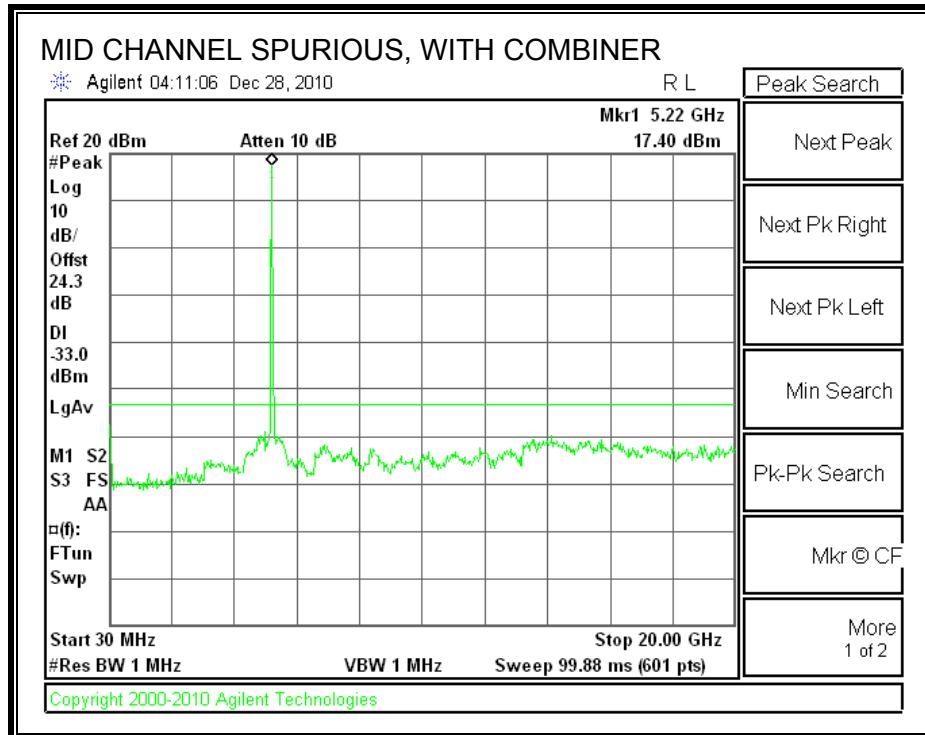
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

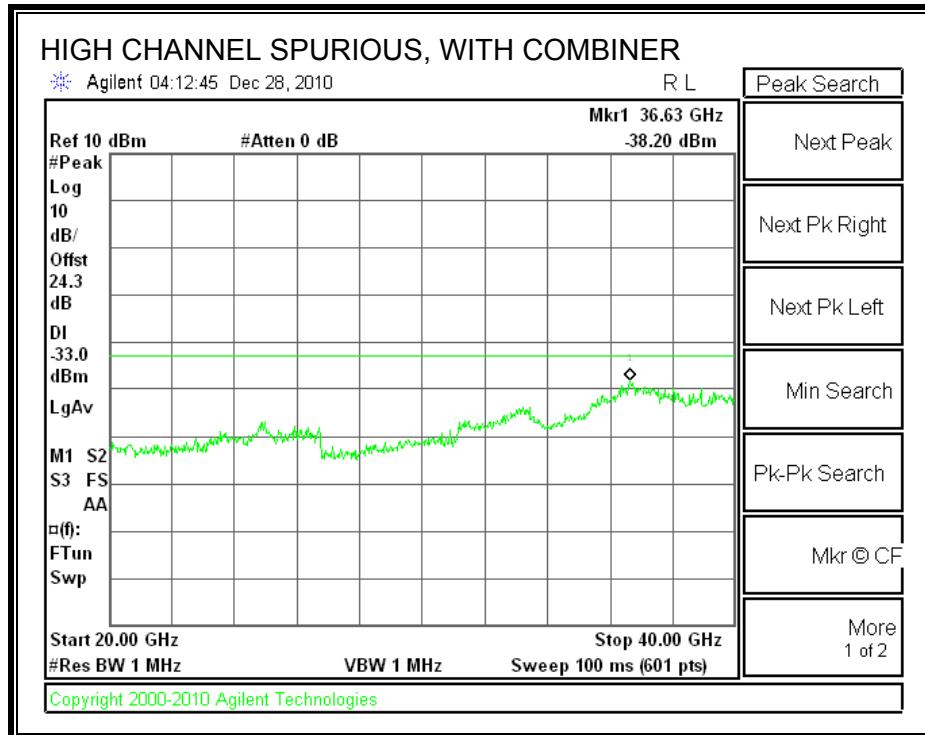
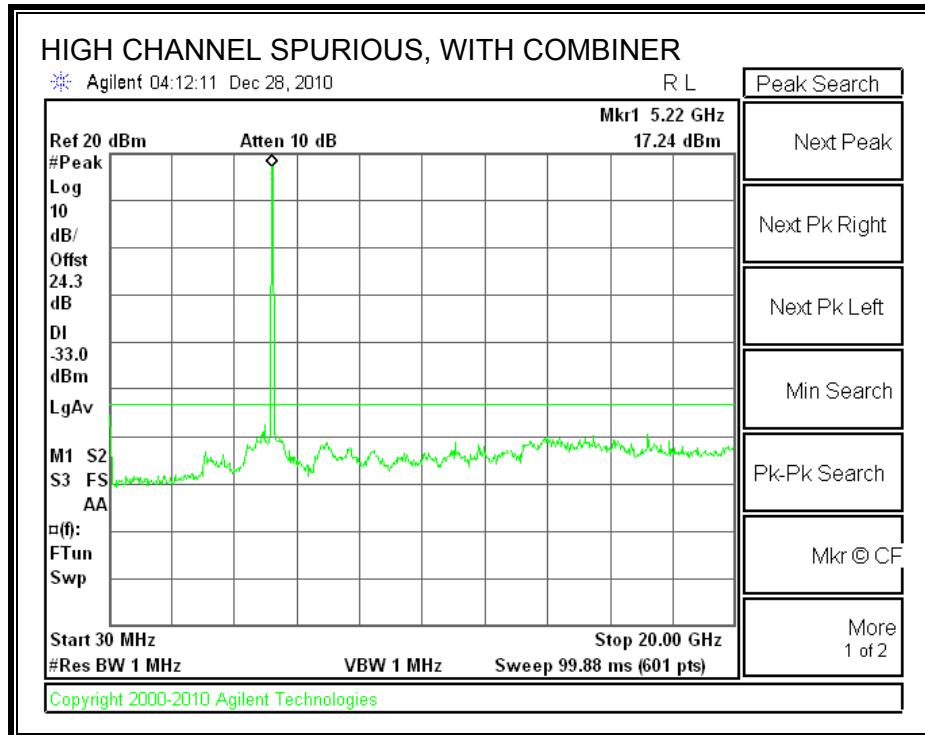
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER







SDM MCS12

7.2.11. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

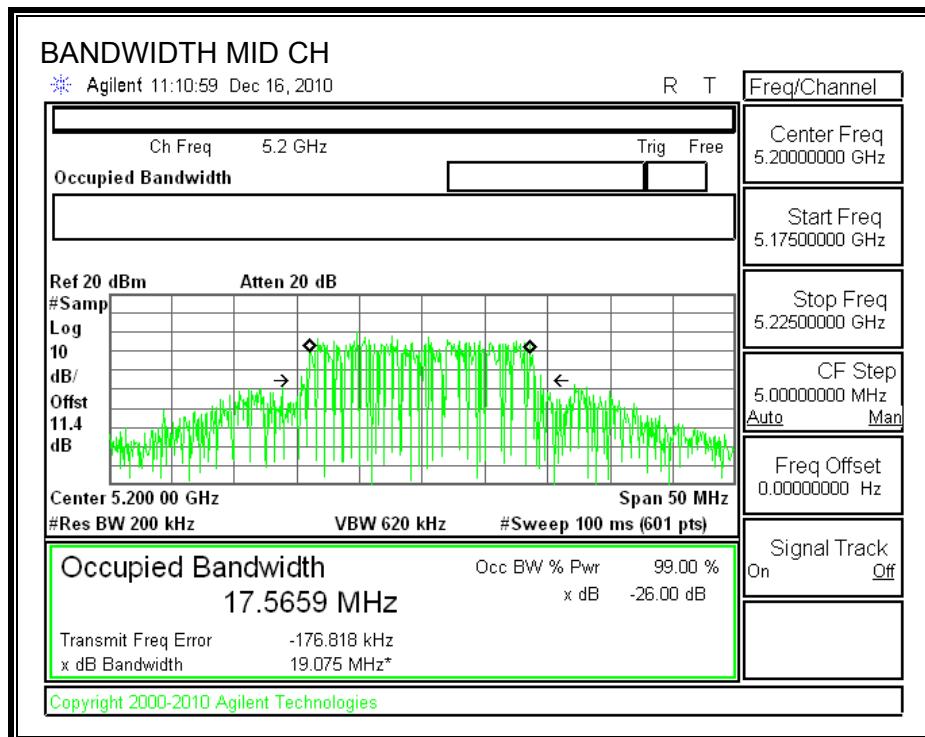
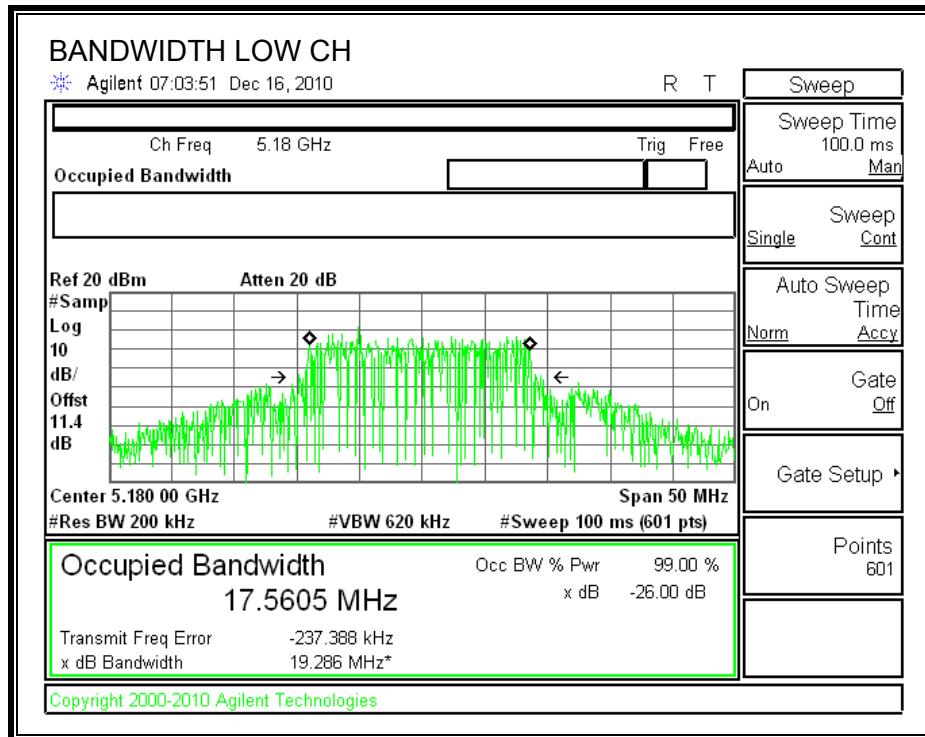
TEST PROCEDURE

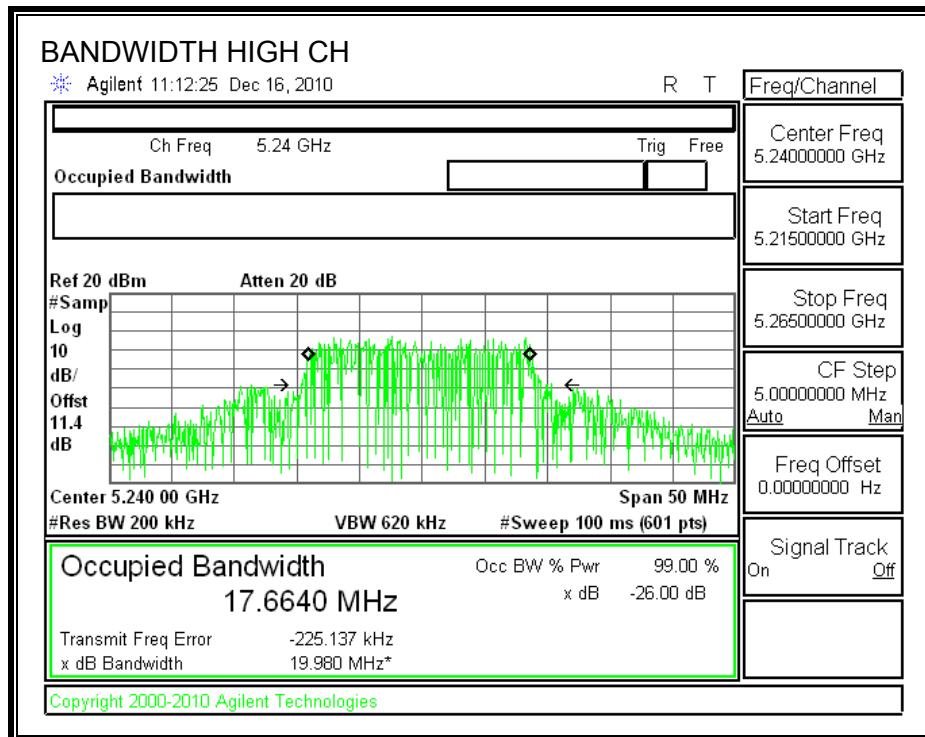
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.286	17.5605
Middle	5200	19.075	17.5659
High	5240	19.980	17.6640

26 dB and 99% BANDWIDTH





7.2.12. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

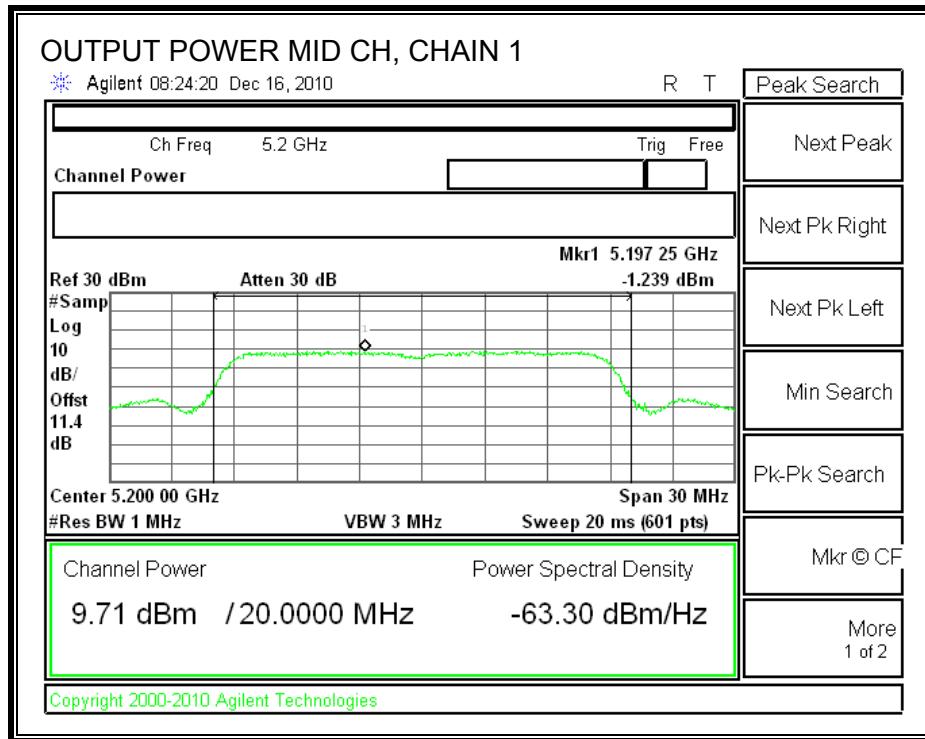
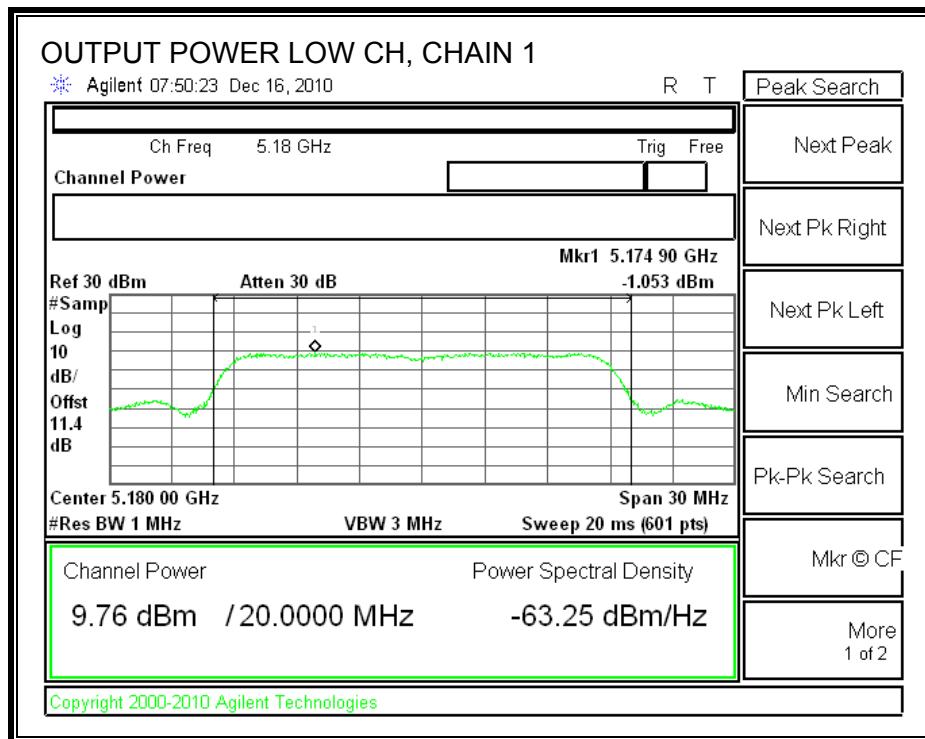
Limit

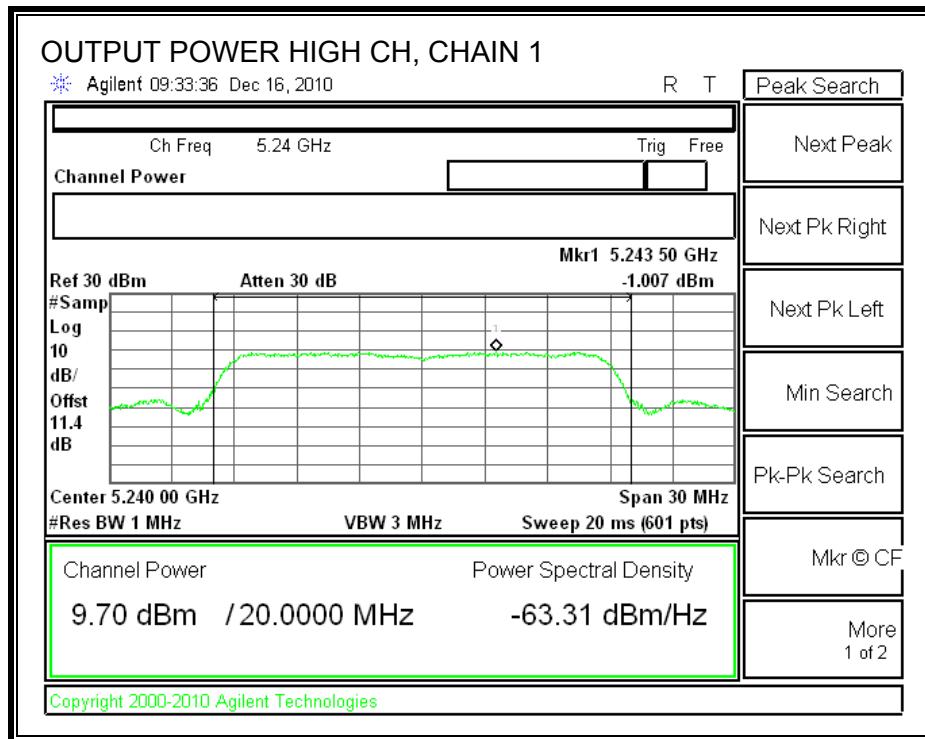
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.286	16.85	6.02	16.83
Mid	5200	16.99	19.113	16.81	6.02	16.79
High	5240	16.99	19.980	17.01	6.02	16.99

Individual Chain Results

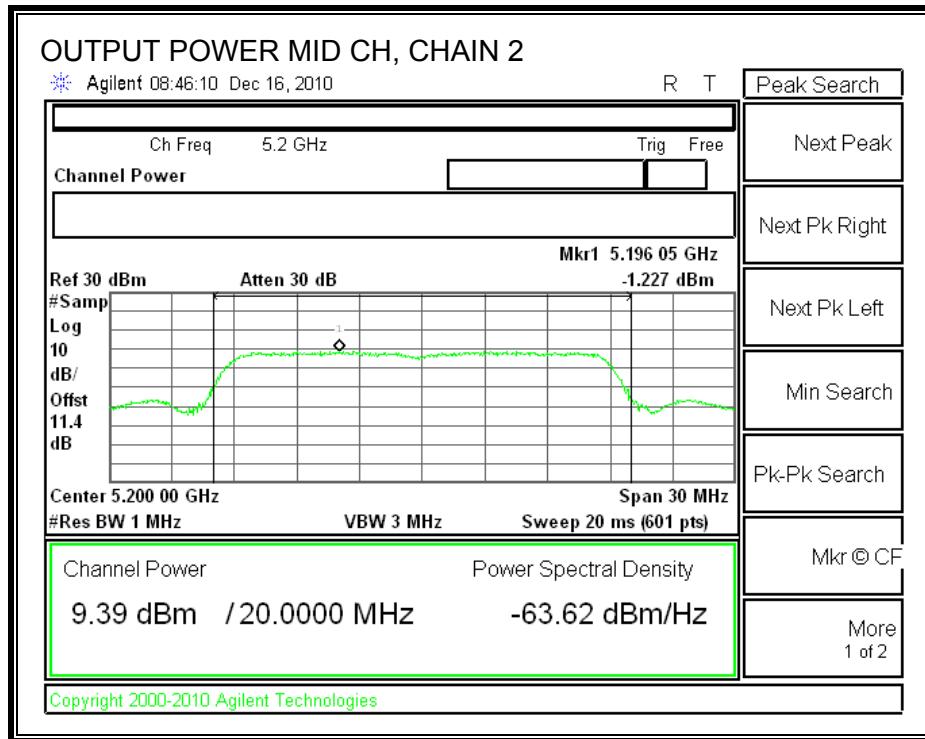
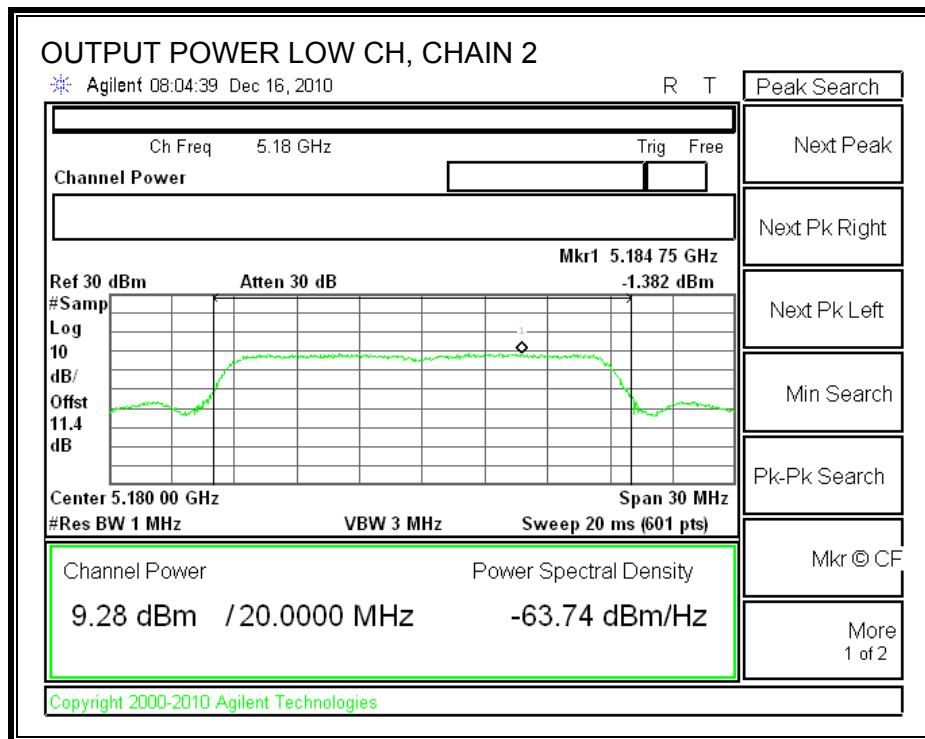
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	9.76	9.28	9.21	14.19	16.83	-2.64
Mid	5200	9.71	9.39	9.16	14.20	16.79	-2.60
High	5240	9.70	9.39	9.12	14.18	16.99	-2.81

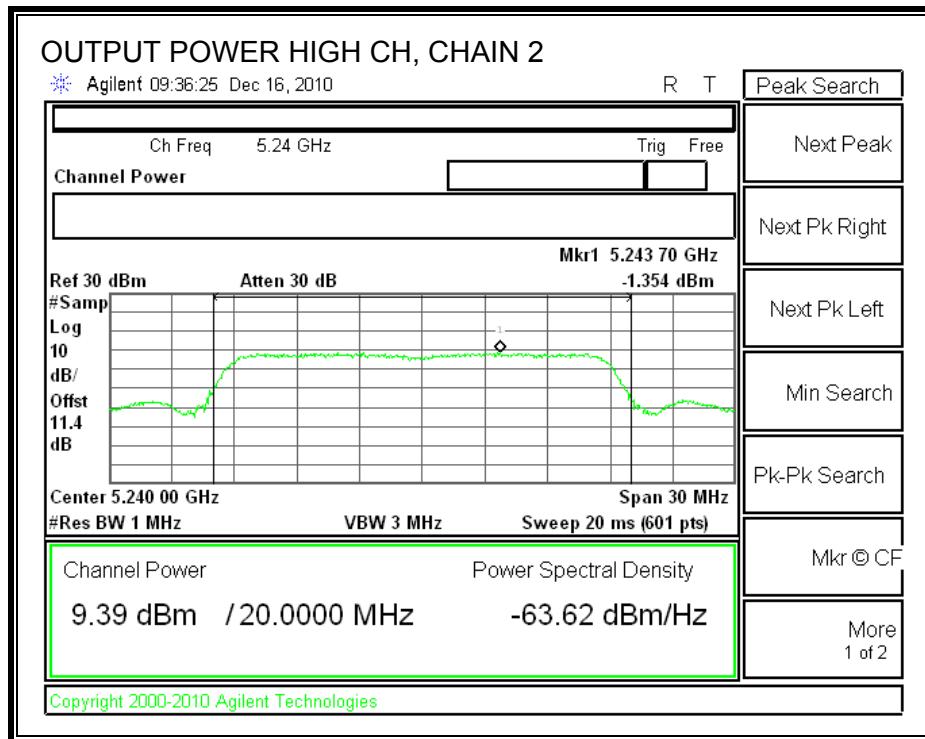
CHAIN 1 OUTPUT POWER



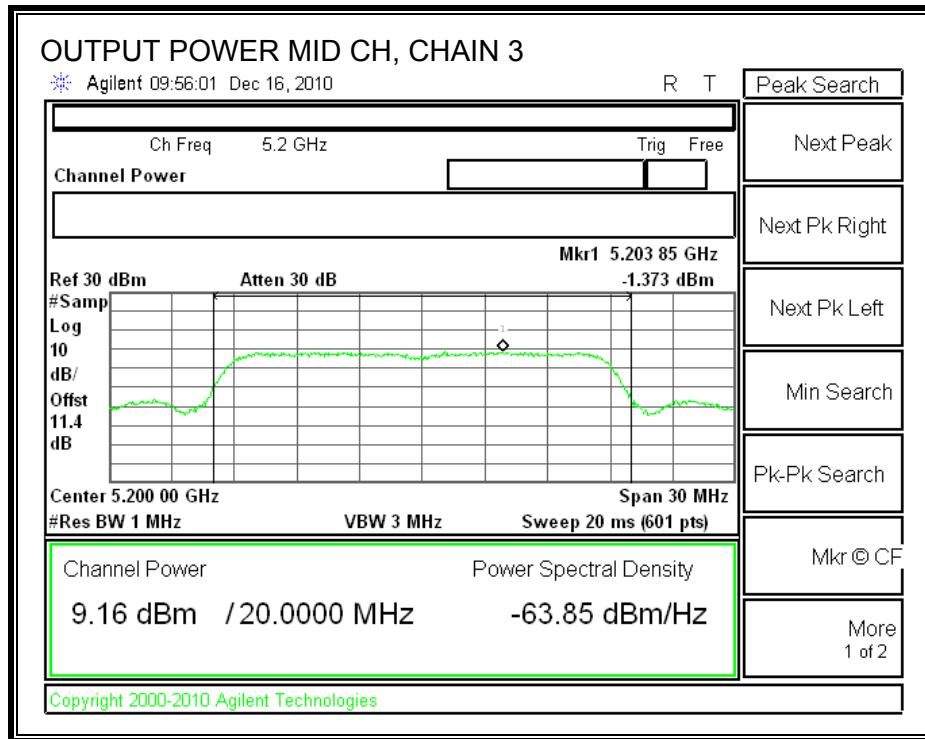
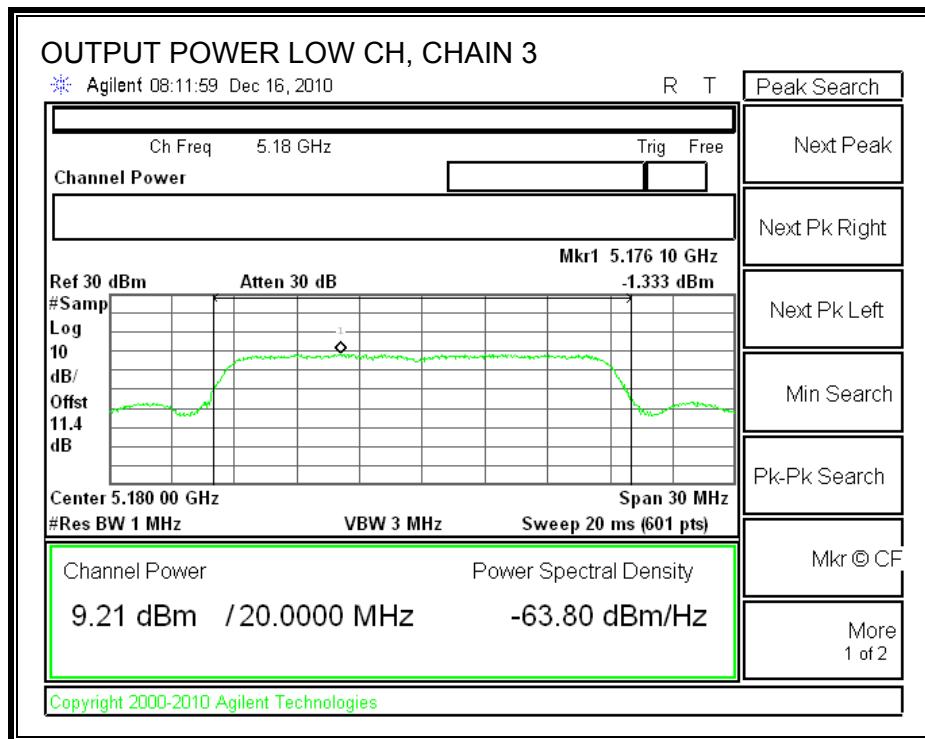


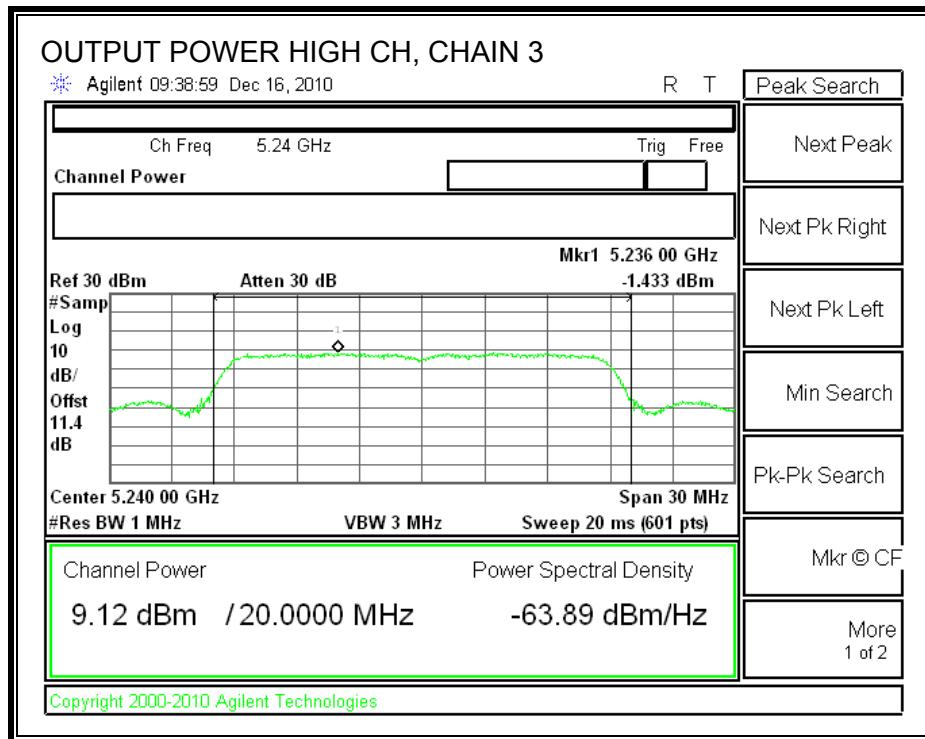
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.2.13. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum effective antenna gain is equal to 6.02 dBi, therefore the limit is 3.98 dBm.

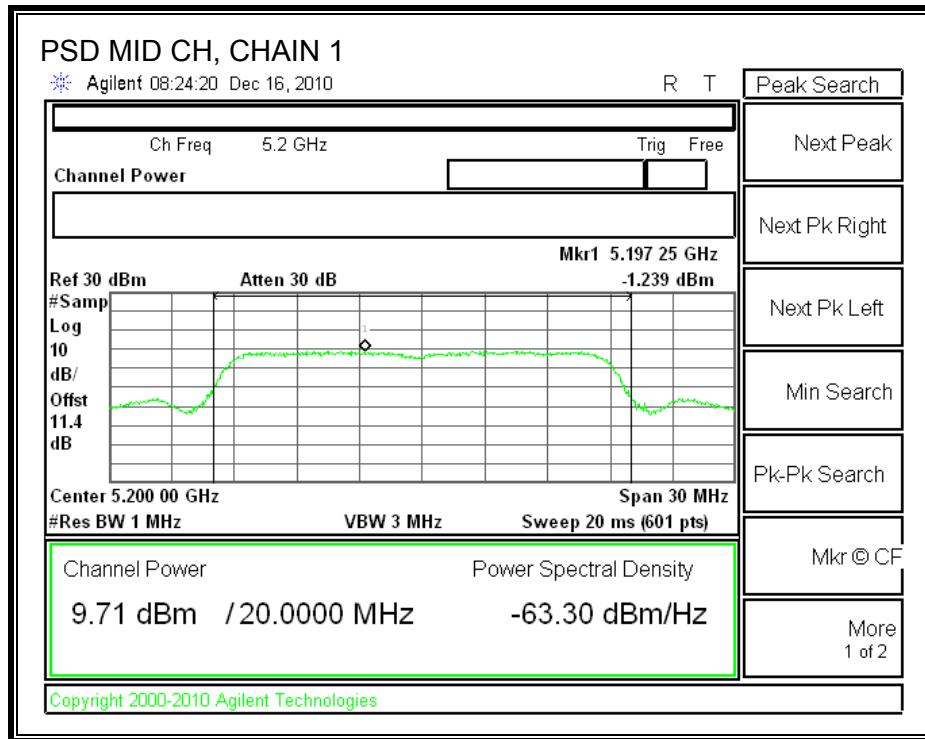
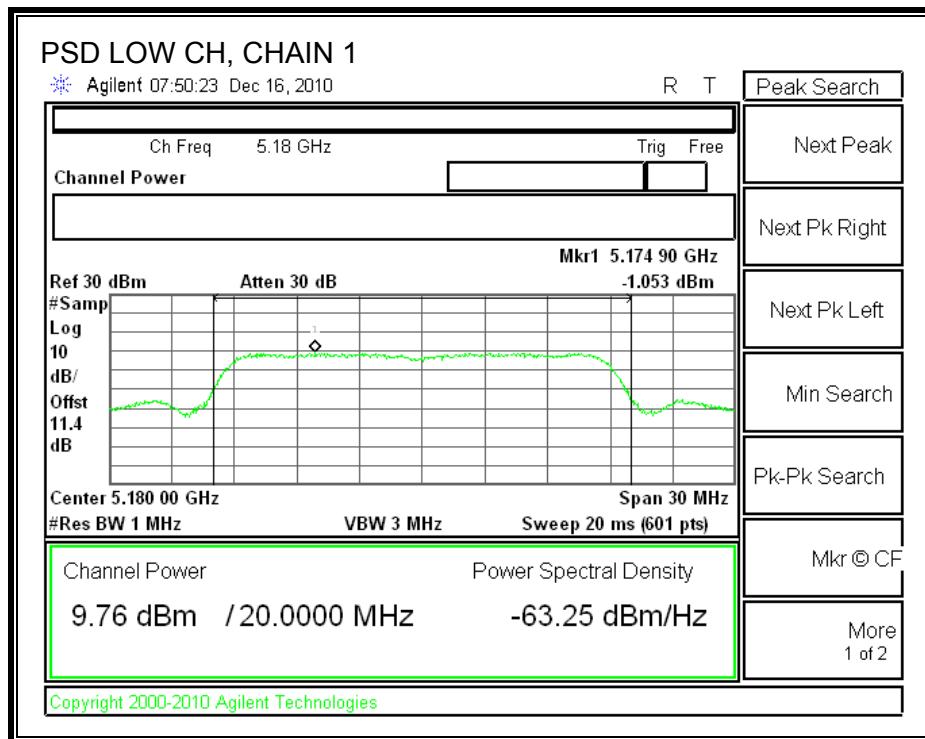
TEST PROCEDURE

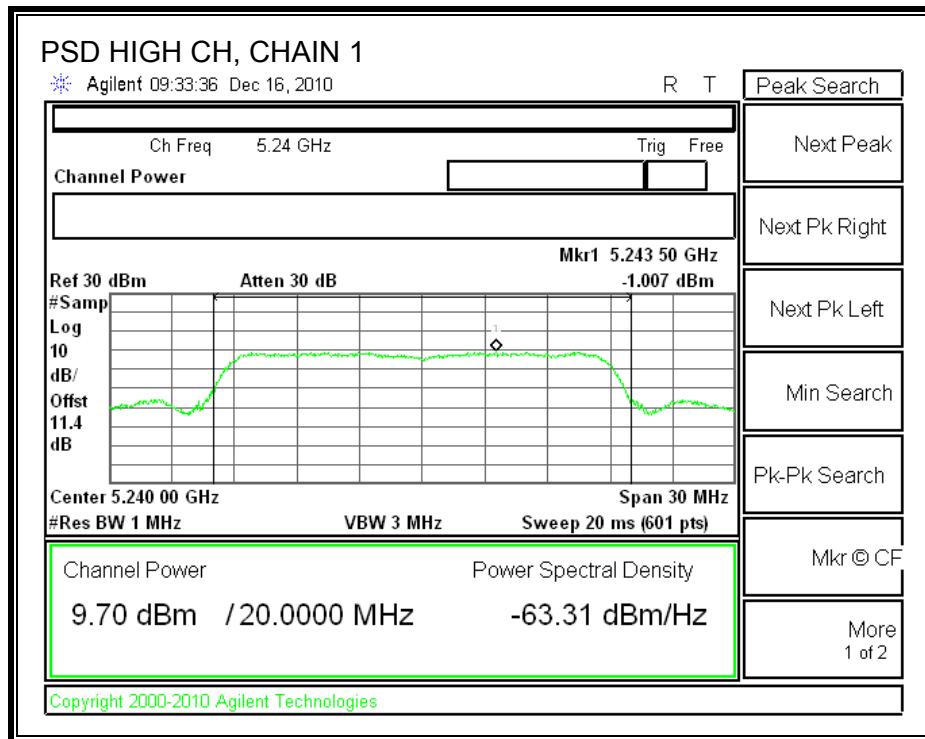
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

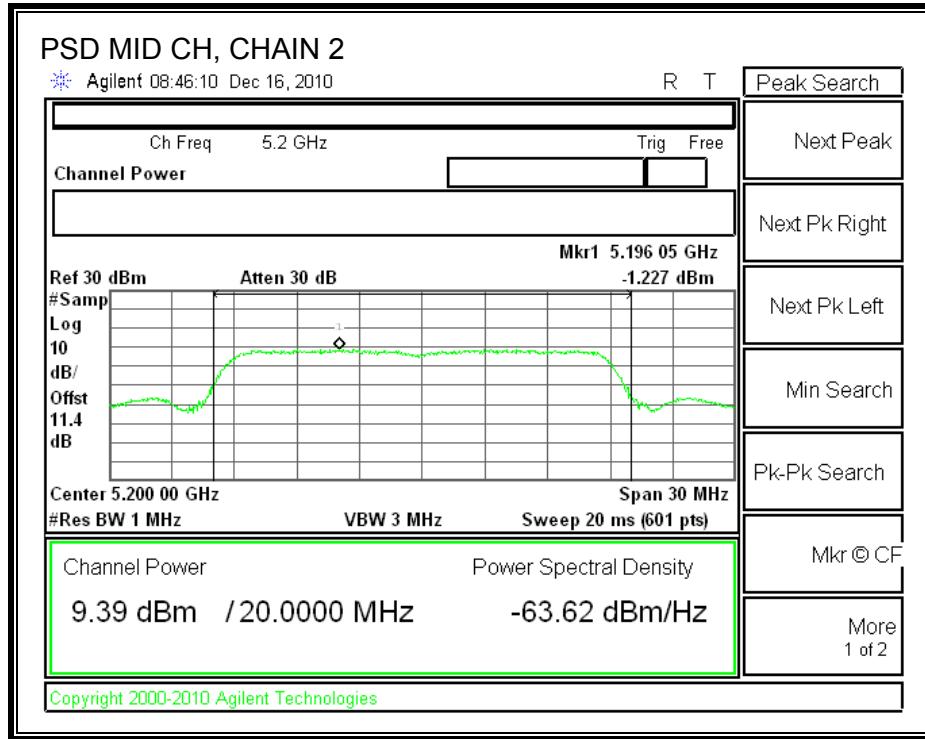
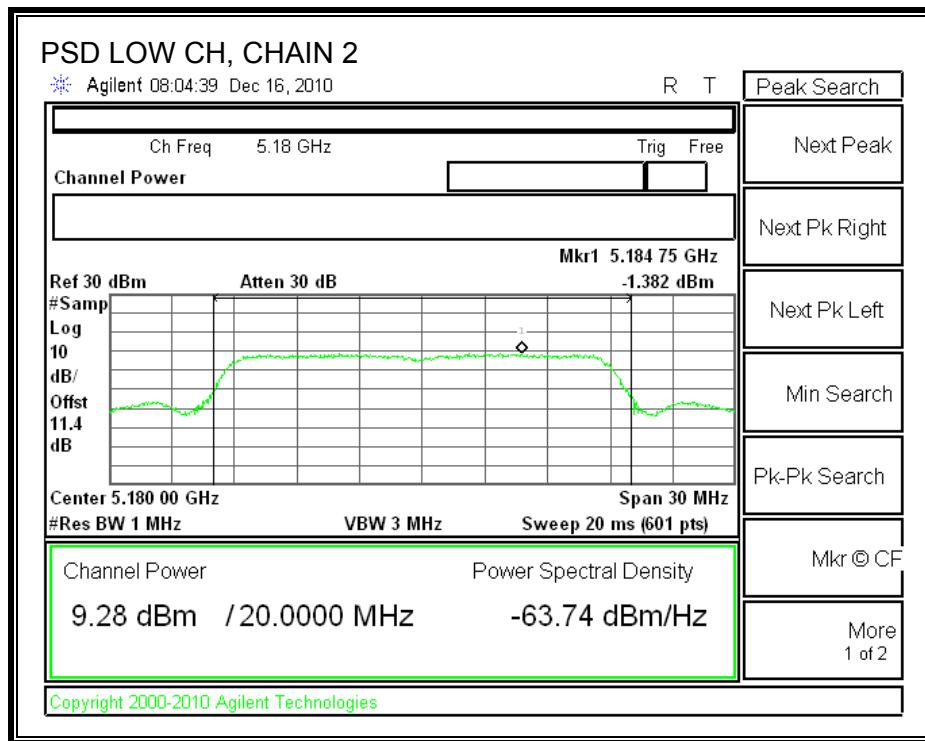
Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.053	-1.382	-1.333	3.52	3.98	-0.46
Middle	5200	-1.239	-1.227	-1.373	3.49	3.98	-0.49
High	5240	-1.007	-1.354	-1.433	3.51	3.98	-0.47

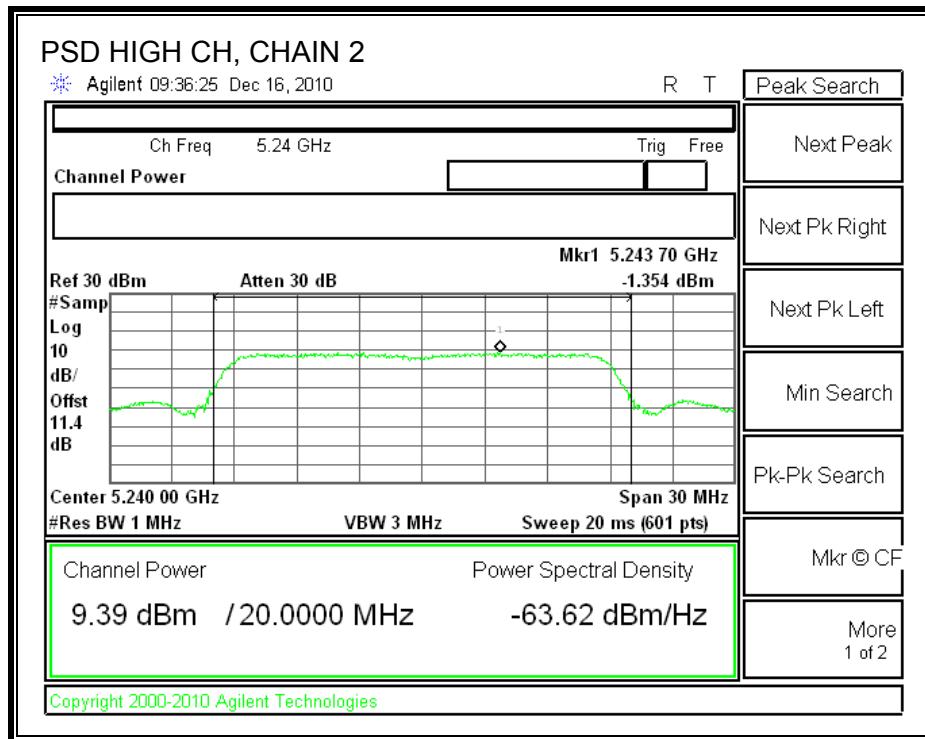
CHAIN 1 POWER SPECTRAL DENSITY



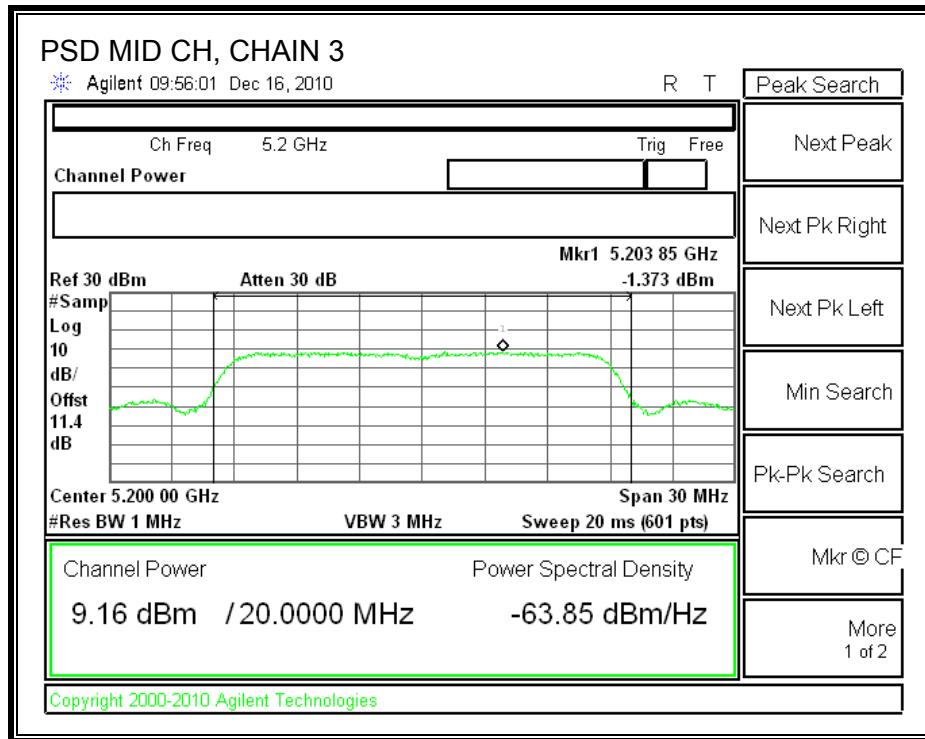
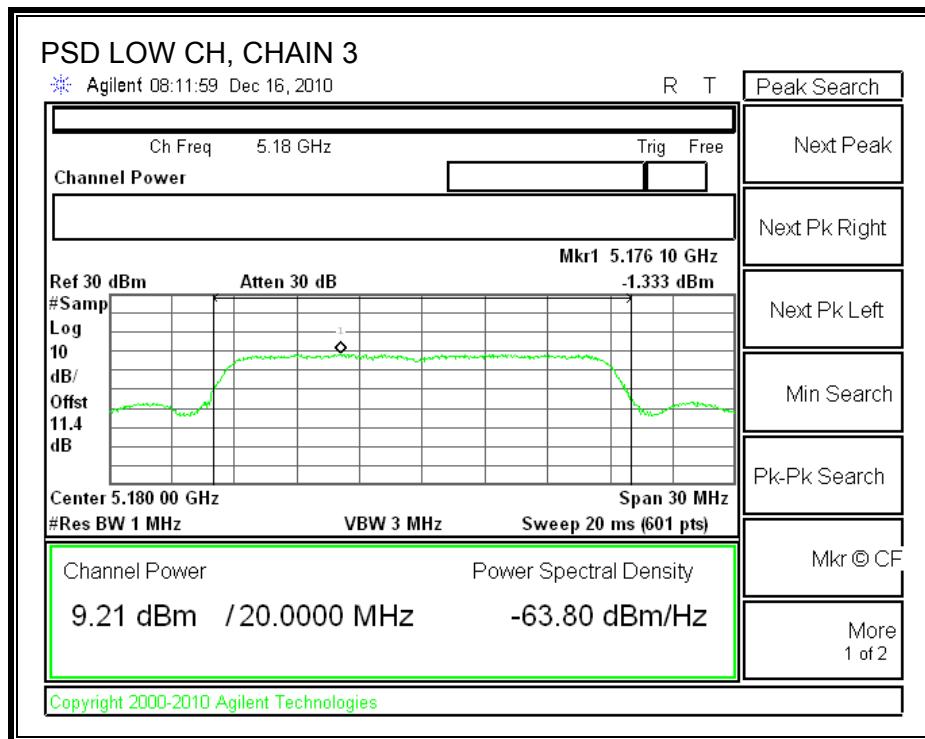


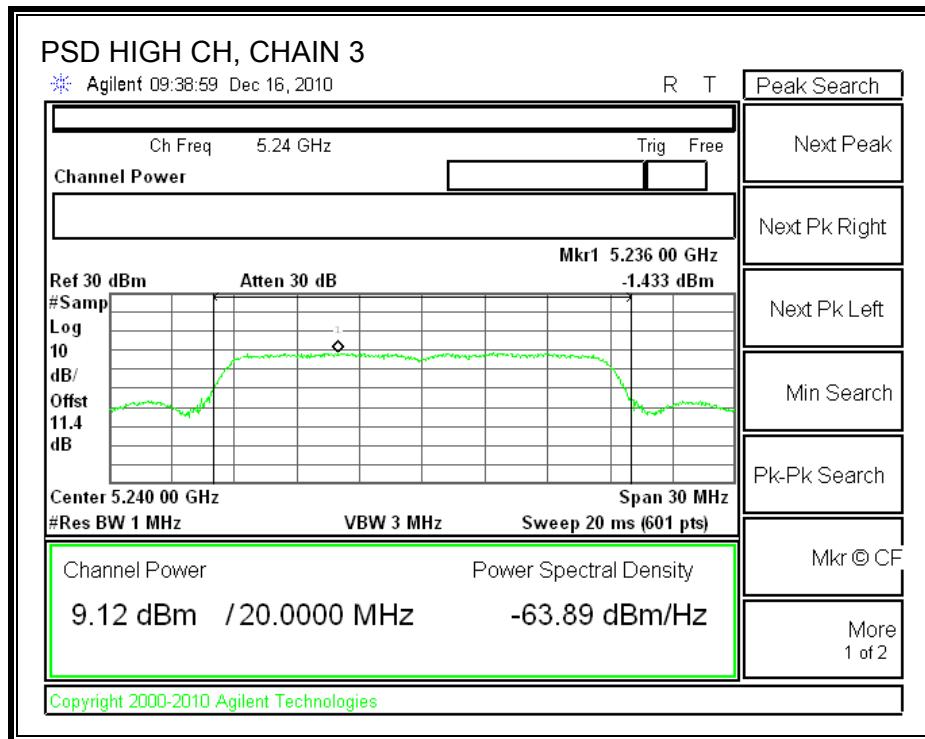
CHAIN 2 POWER SPECTRAL DENSITY





CHAIN 3 POWER SPECTRAL DENSITY





7.2.14. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

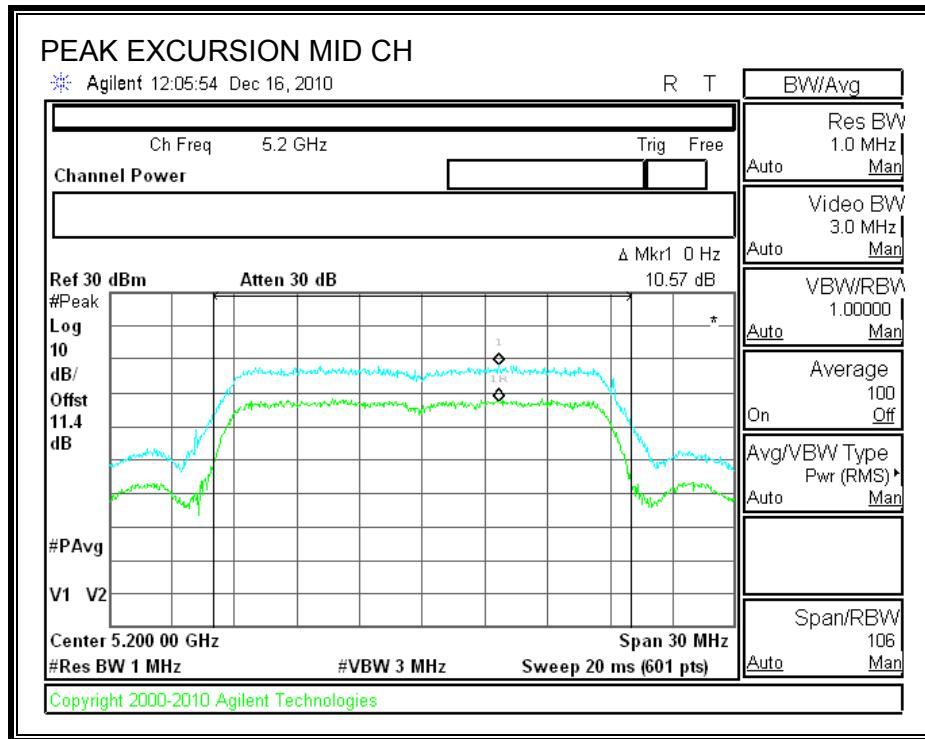
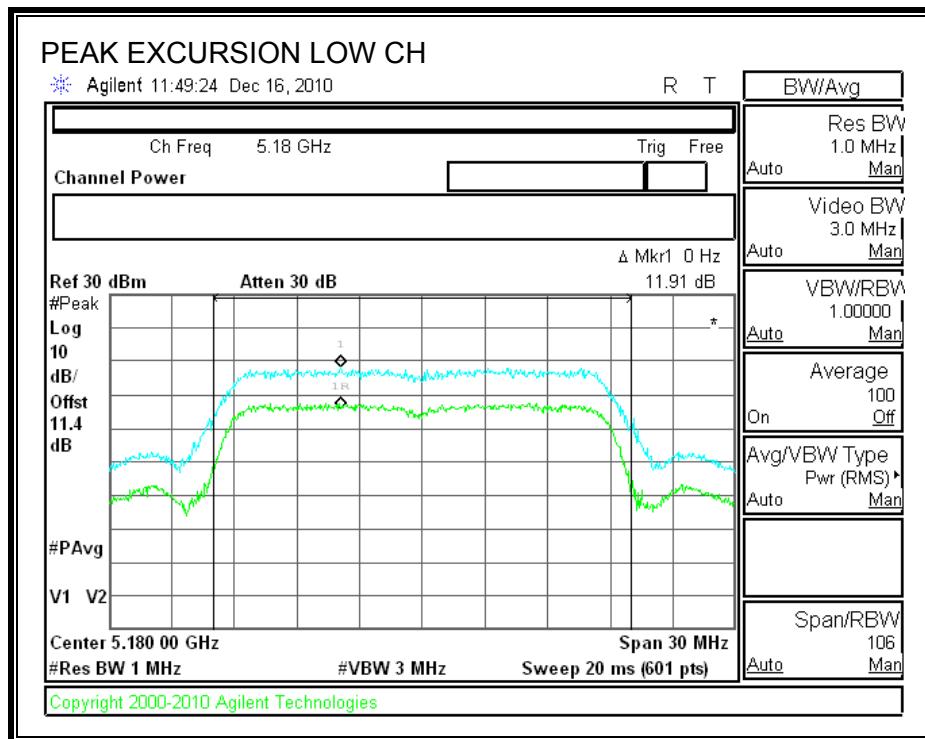
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

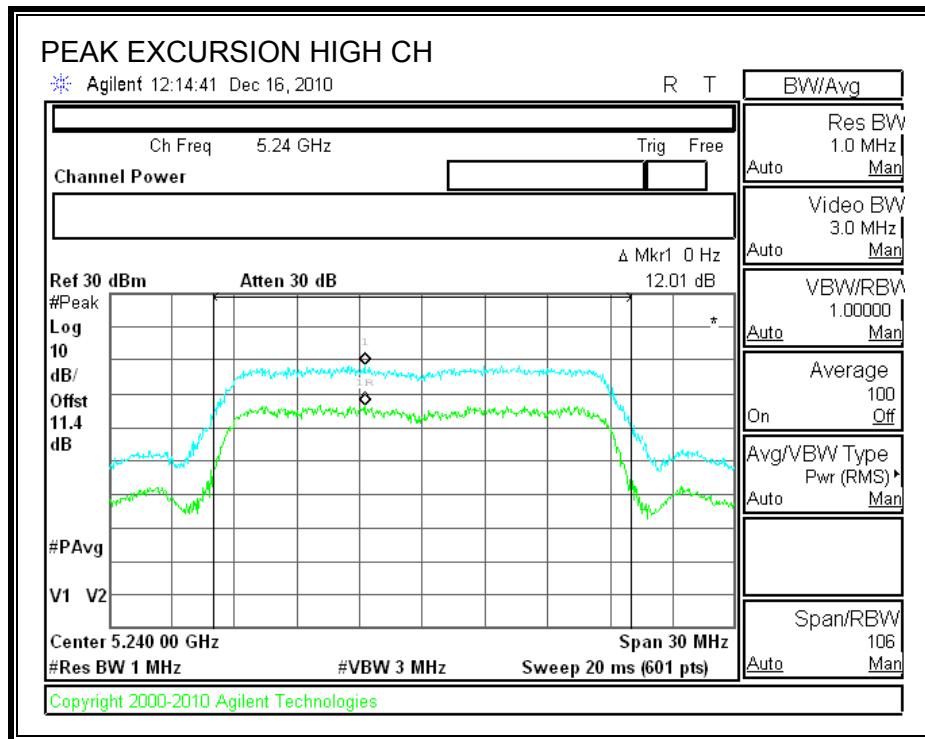
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	11.91	13	-1.09
Middle	5200	10.57	13	-2.43
High	5240	12.01	13	-0.99

PEAK EXCURSION





7.2.15. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

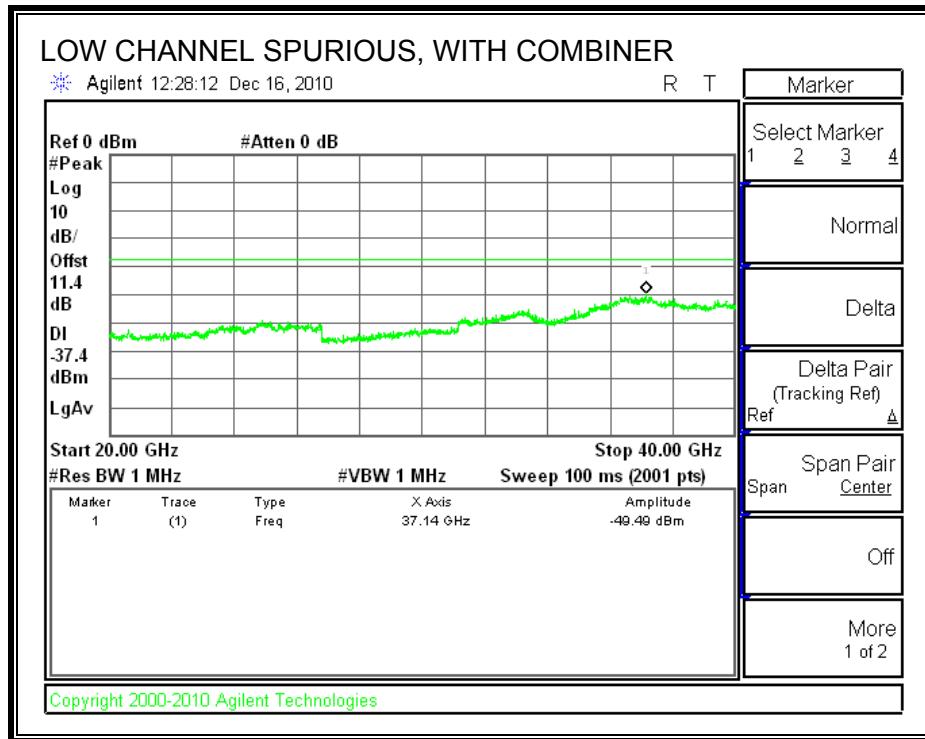
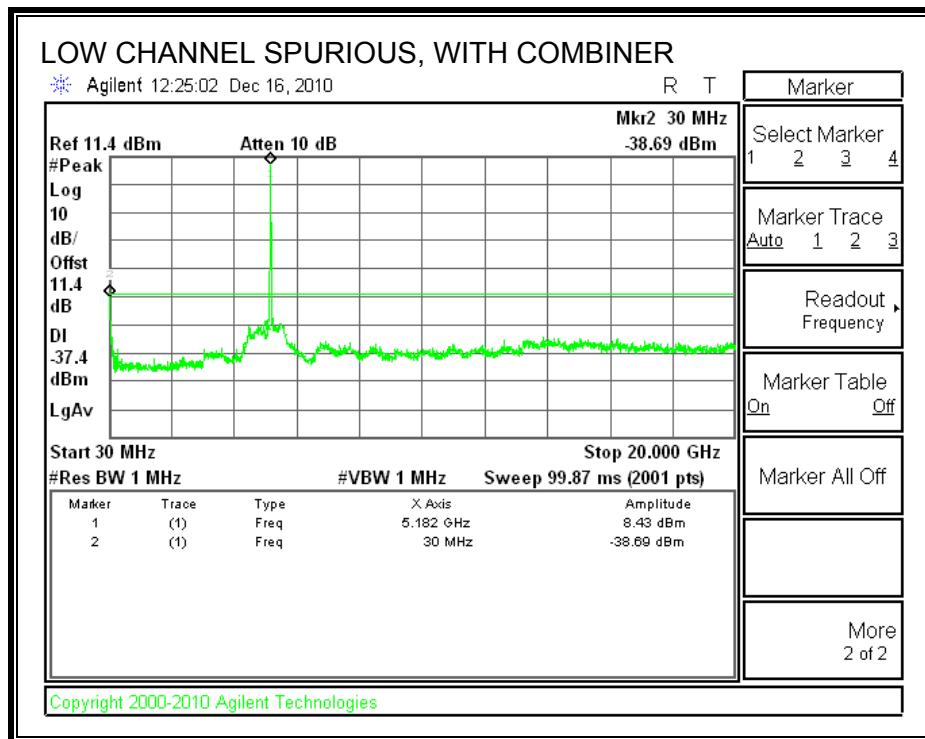
TEST PROCEDURE

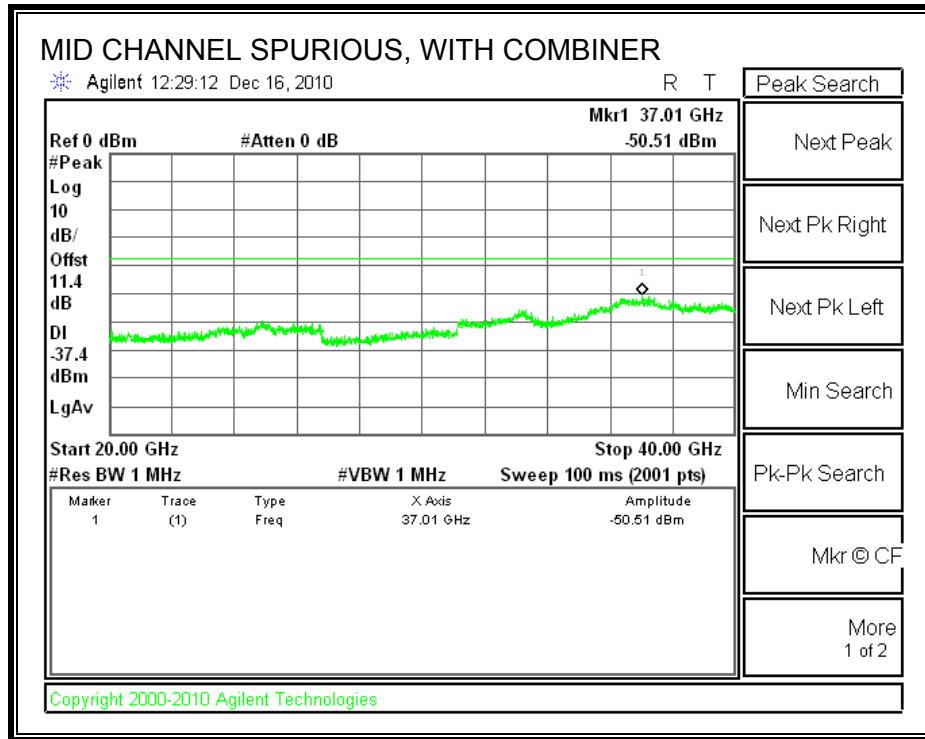
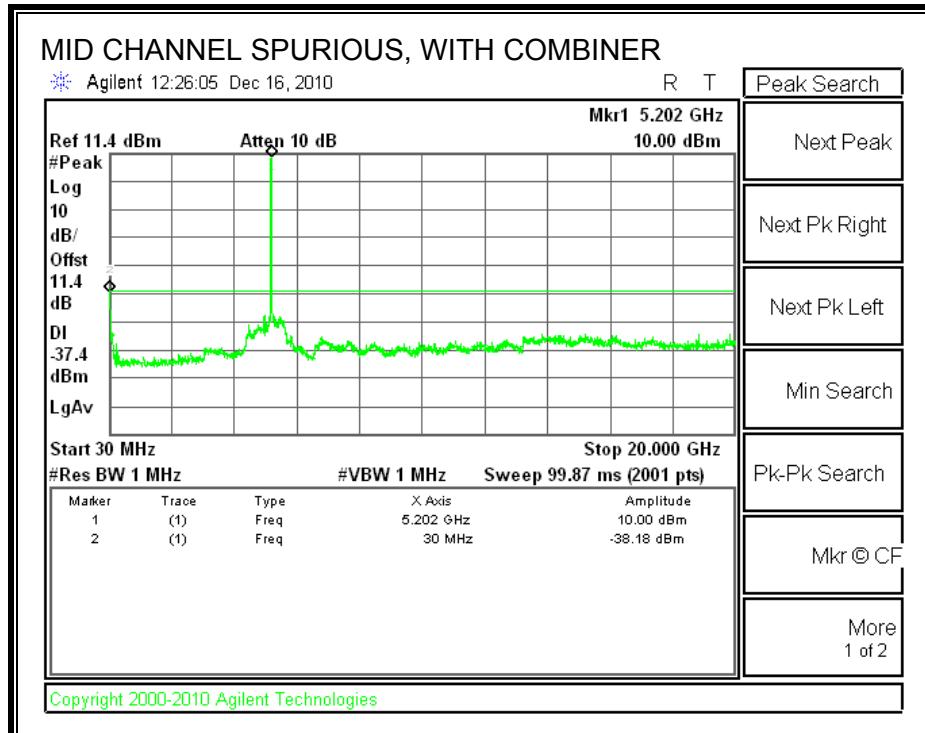
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

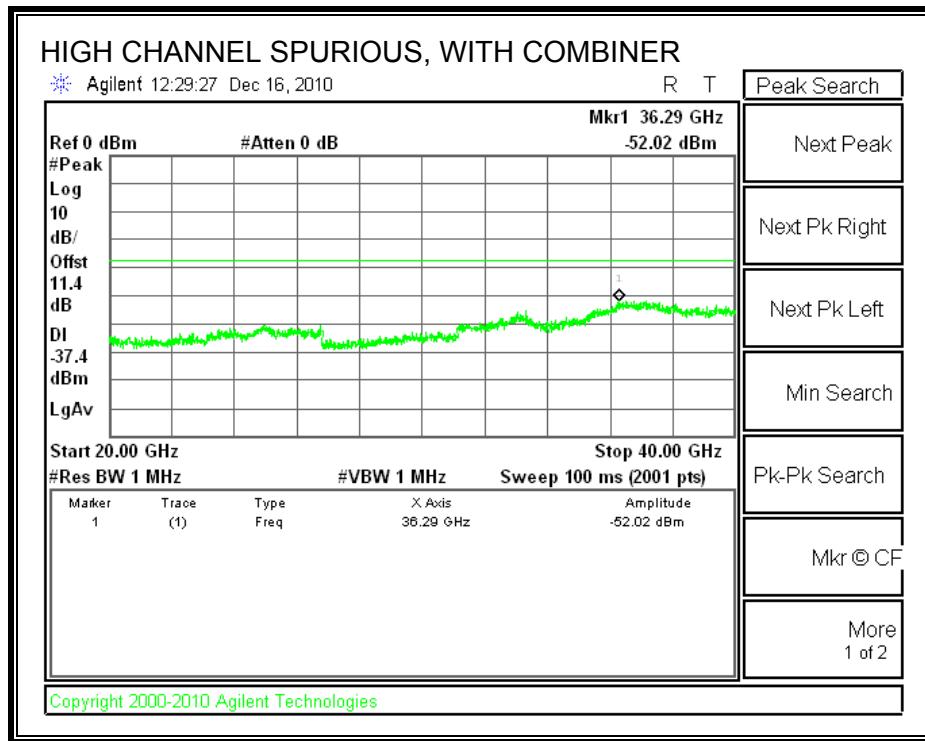
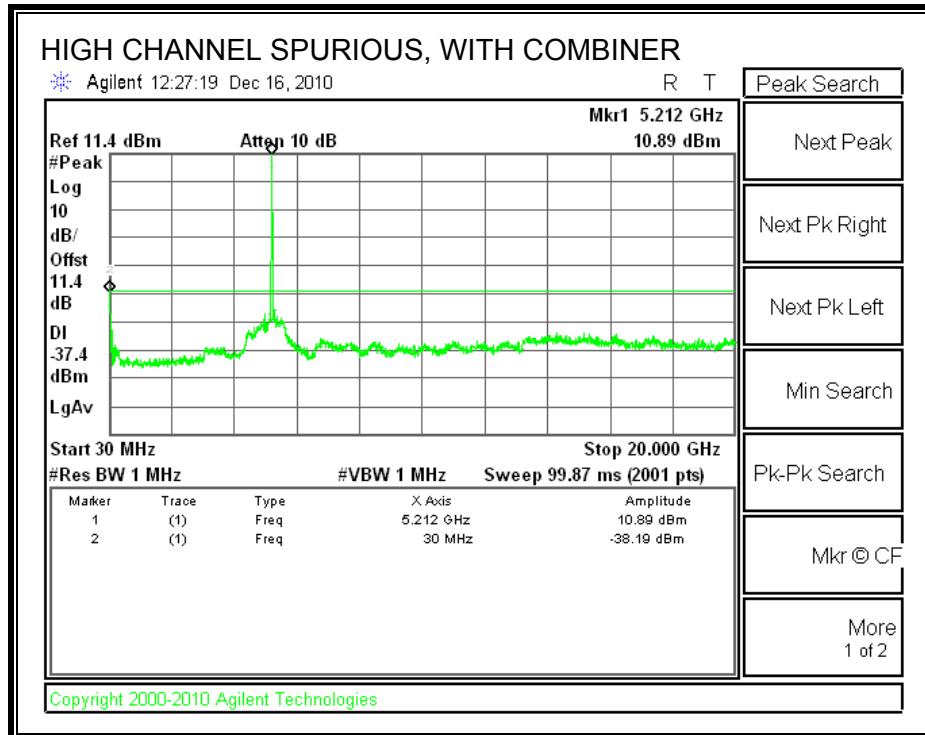
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER







SDM MCS16

7.2.16. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

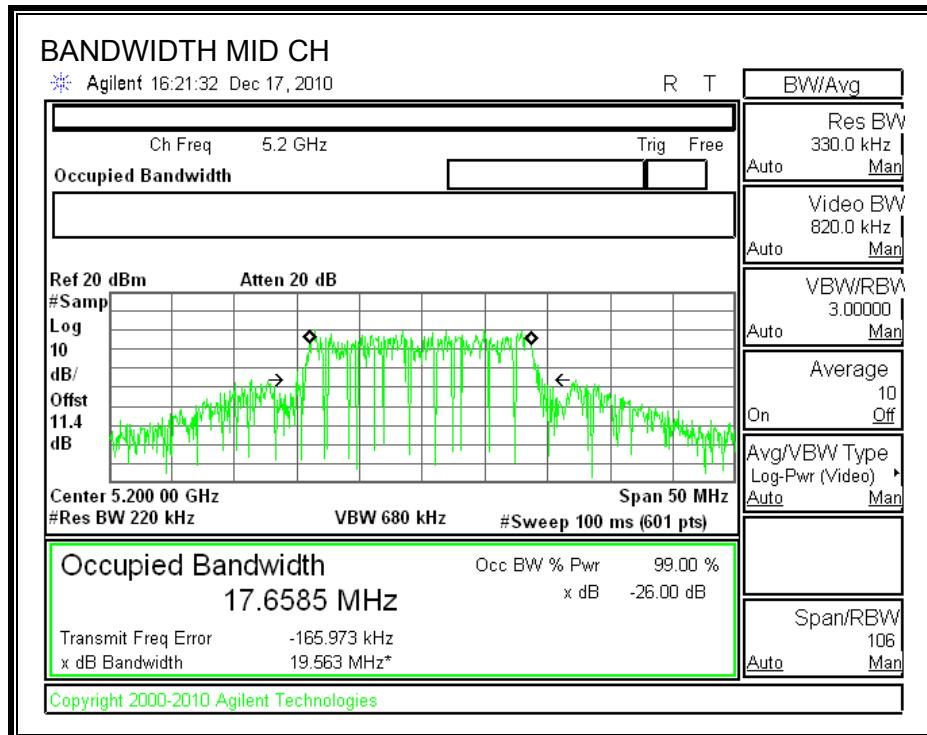
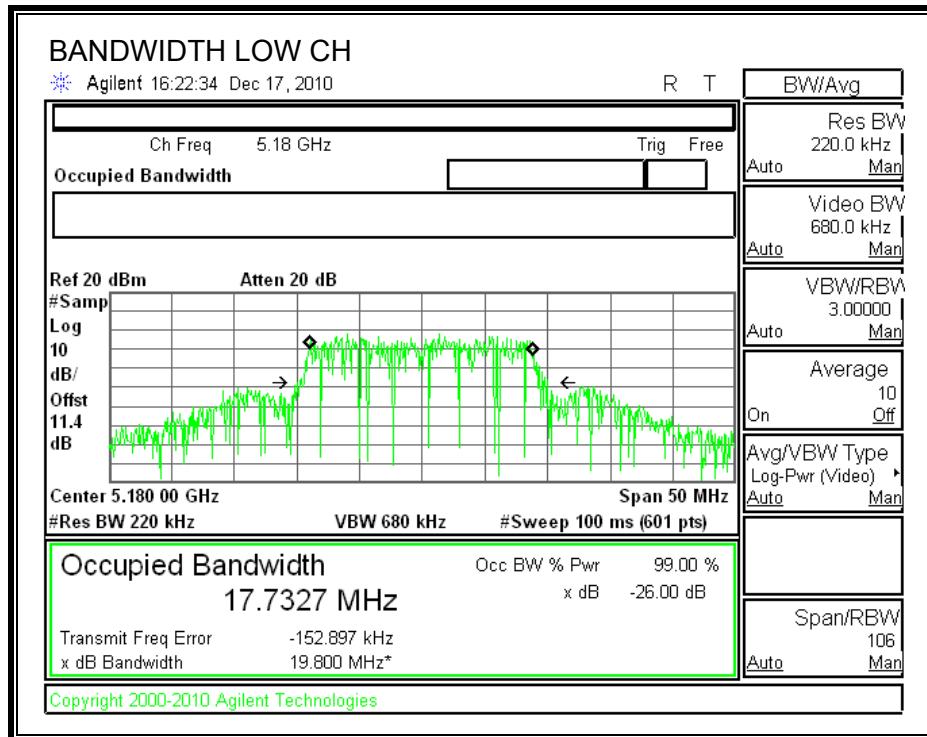
TEST PROCEDURE

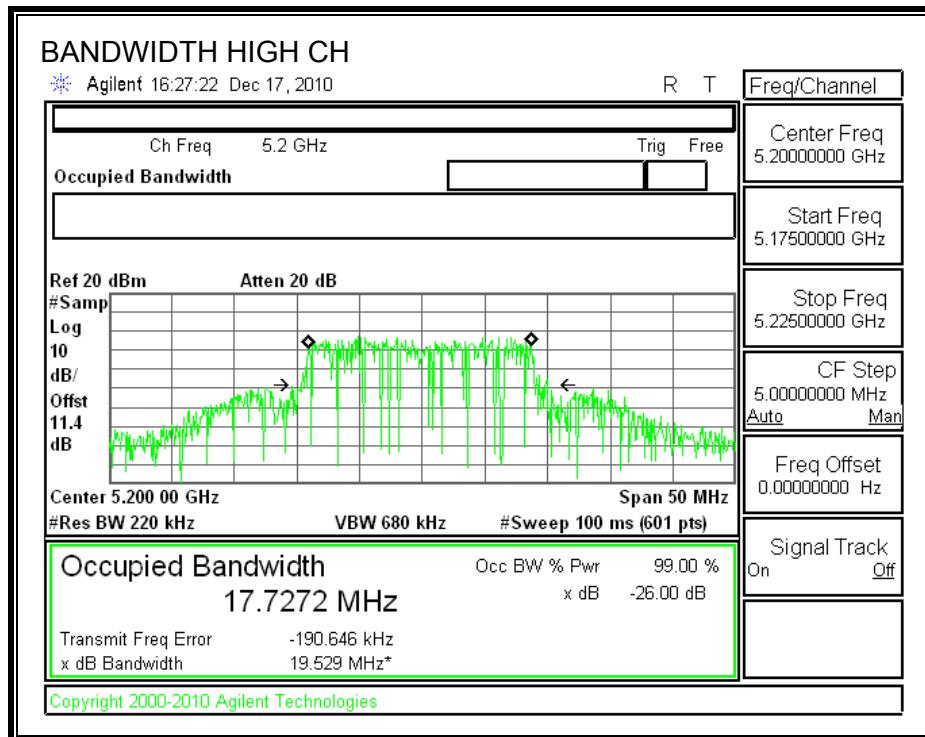
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.800	17.7327
Middle	5200	19.563	17.6585
High	5240	19.529	17.7272

26 dB and 99% BANDWIDTH





7.2.17. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

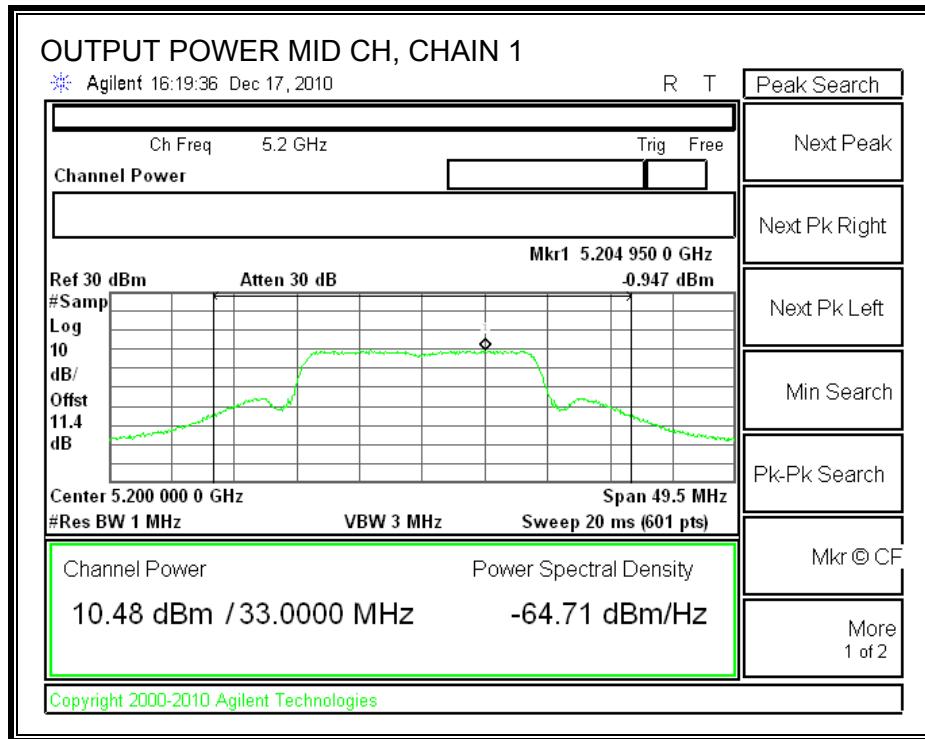
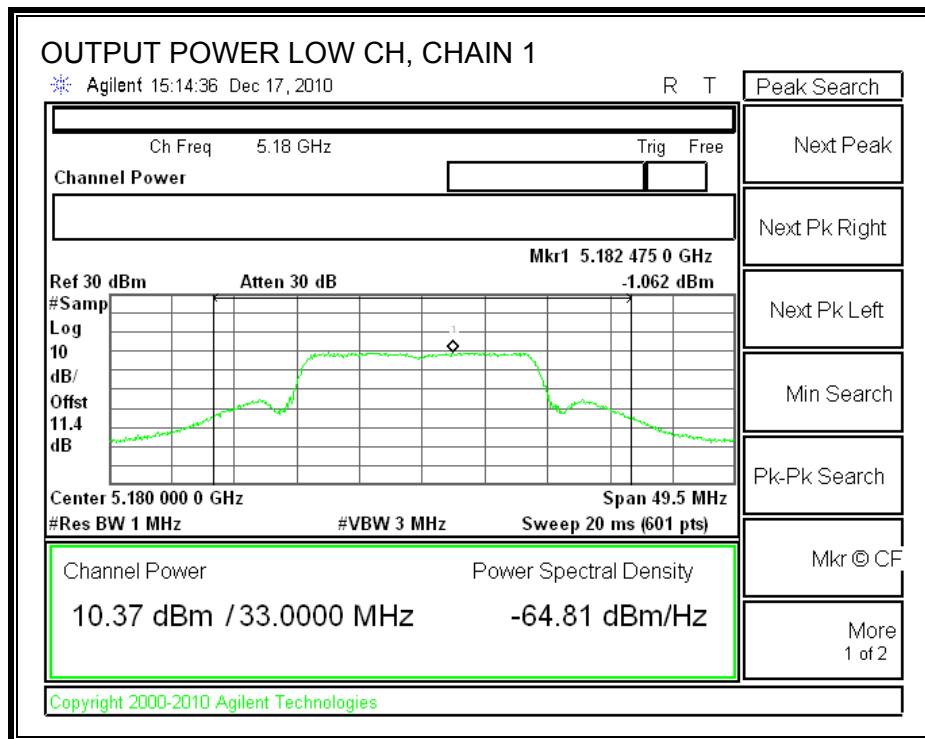
Limit

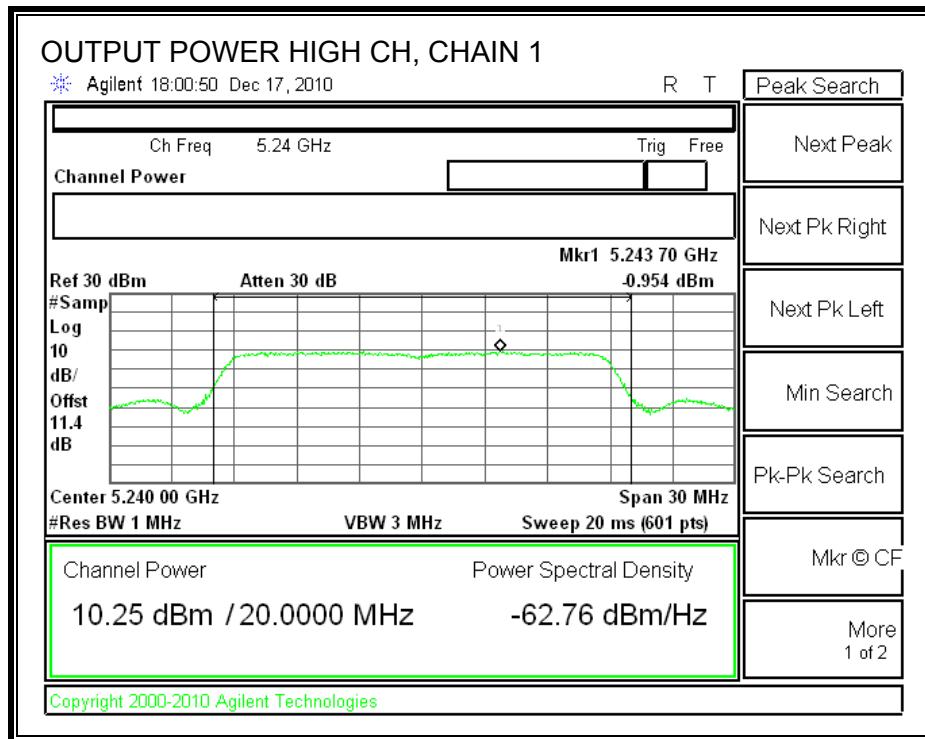
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.800	16.97	6.02	16.95
Mid	5200	16.99	19.563	16.91	6.02	16.89
High	5240	16.99	19.529	16.91	6.02	16.91

Individual Chain Results

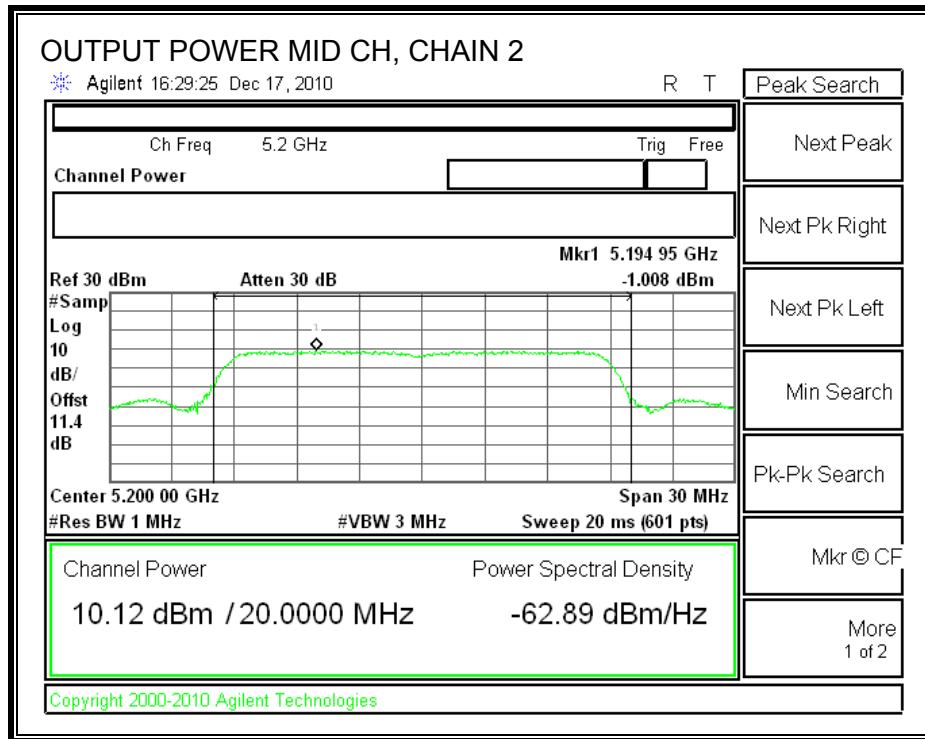
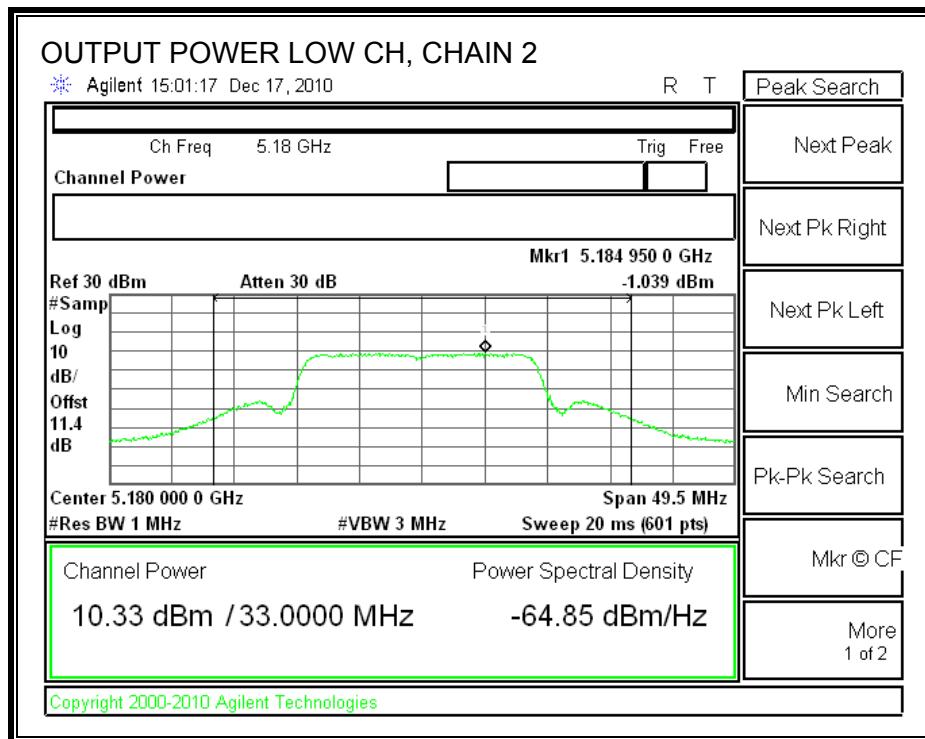
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.37	10.33	10.20	15.07	16.95	-1.87
Mid	5200	10.48	10.12	9.95	14.96	16.89	-1.93
High	5240	10.25	10.33	9.70	14.87	16.91	-2.03

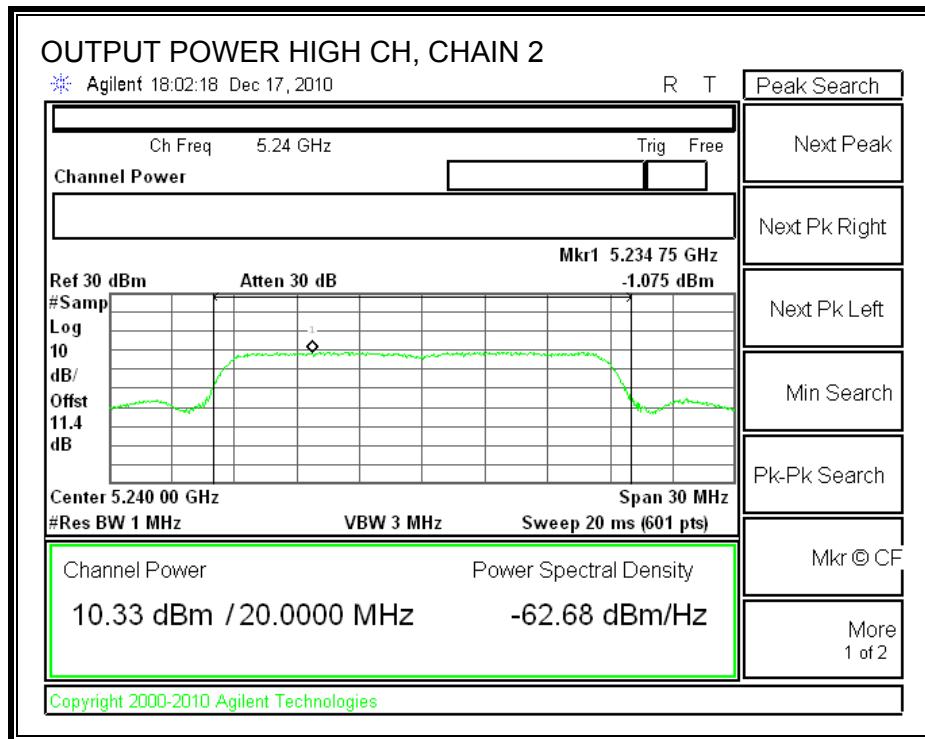
CHAIN 1 OUTPUT POWER



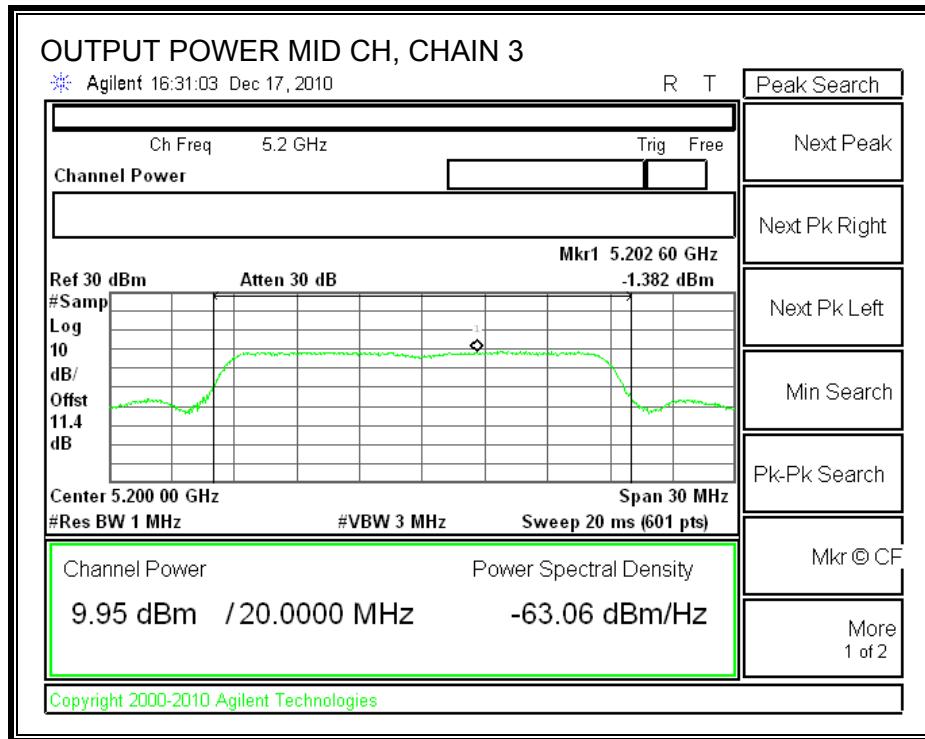
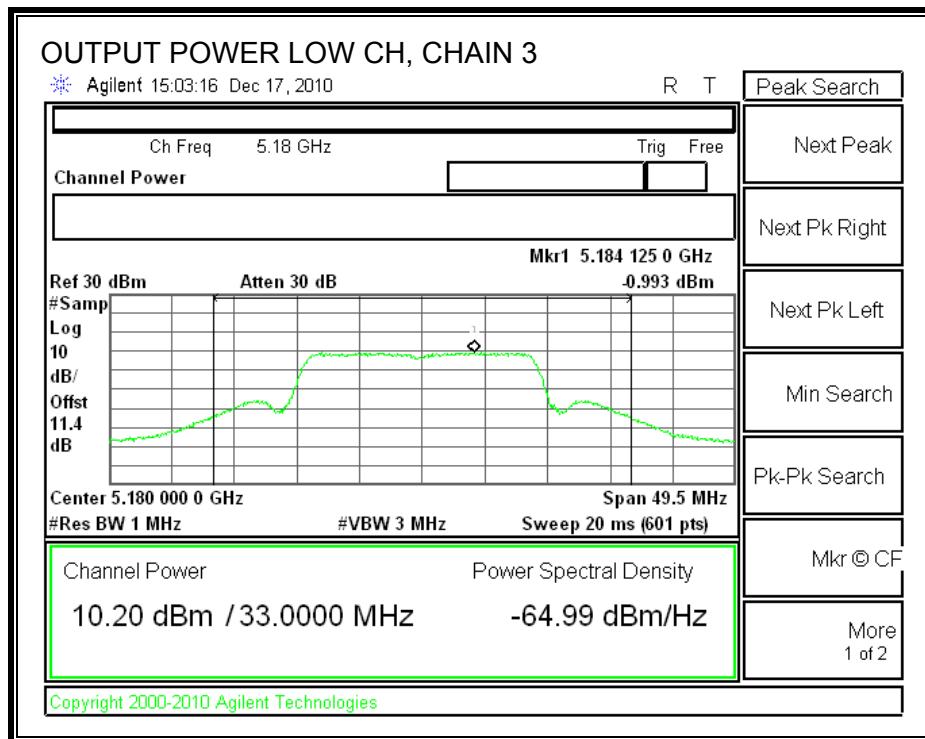


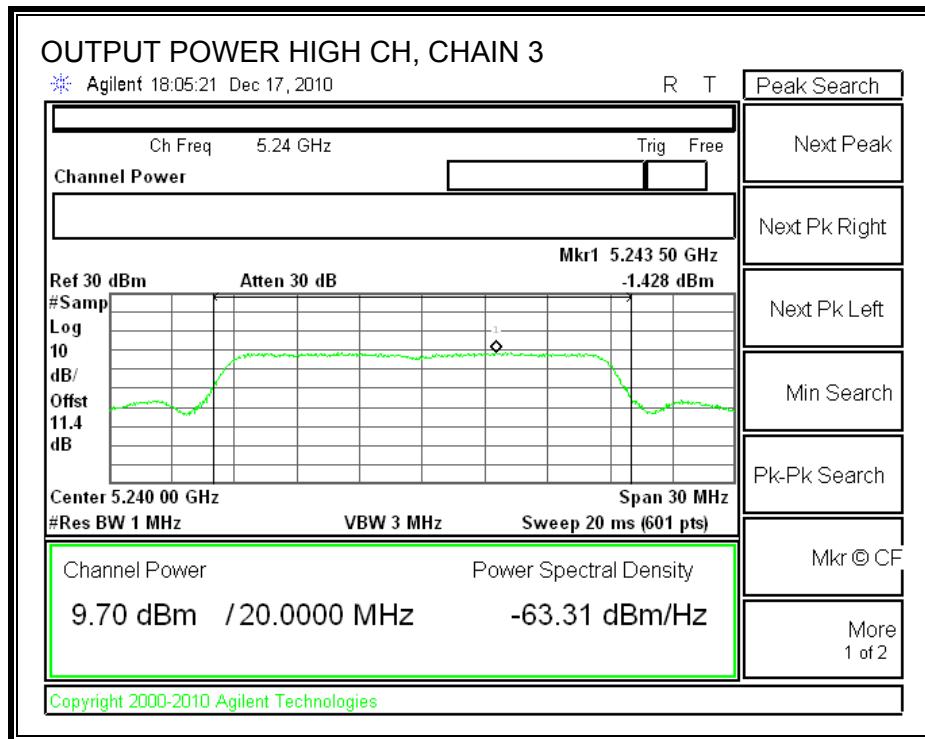
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.2.18. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is equal to 6.02 dBi, therefore the limit is 3.98 dBm.

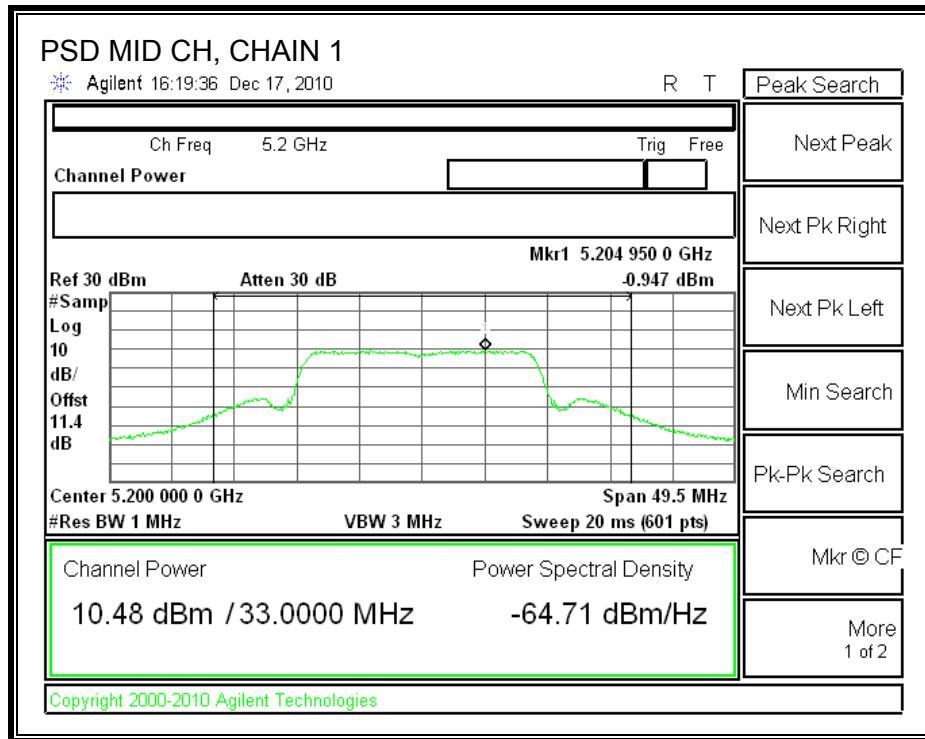
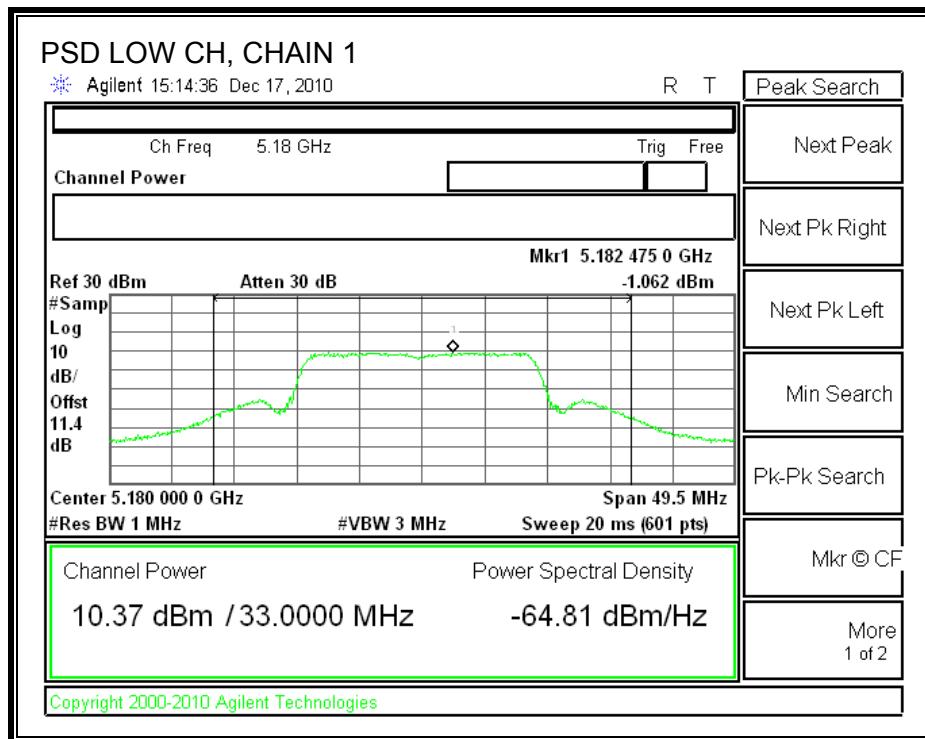
TEST PROCEDURE

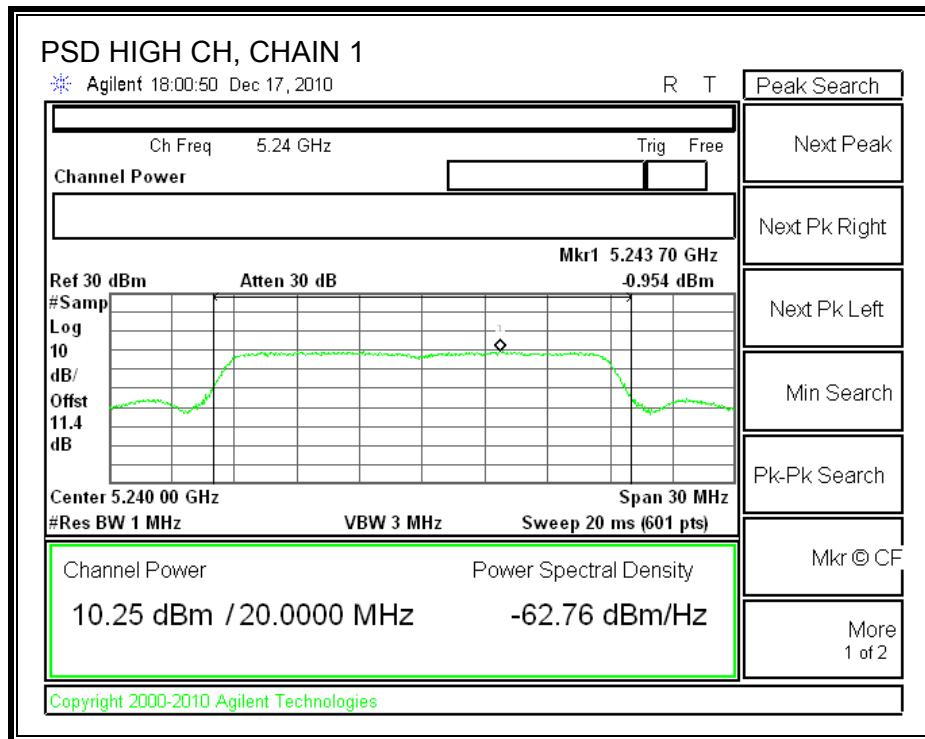
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

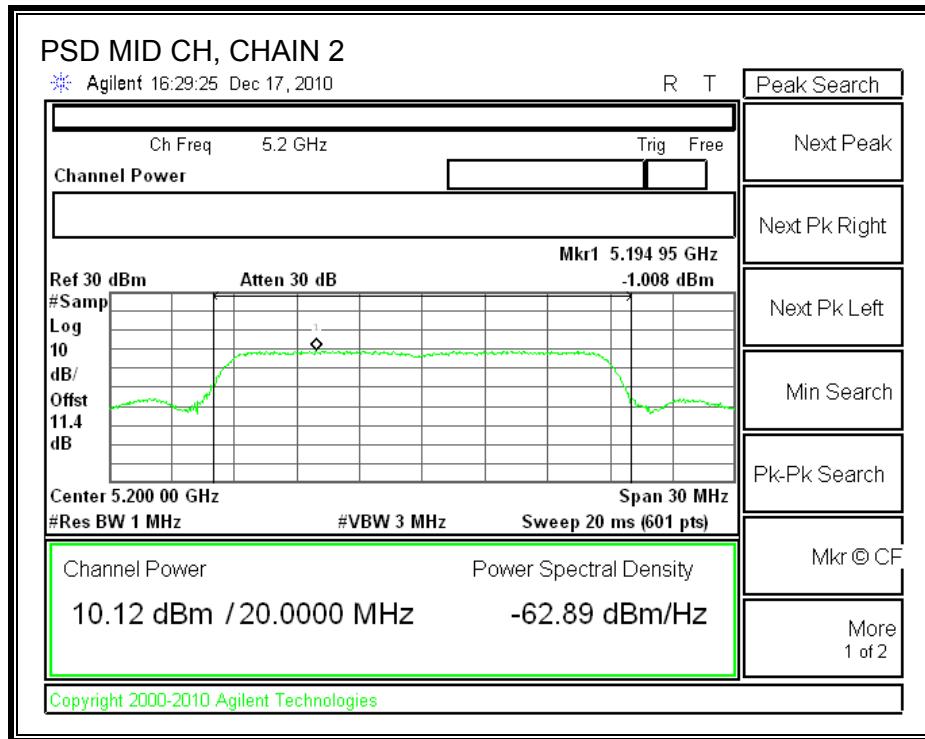
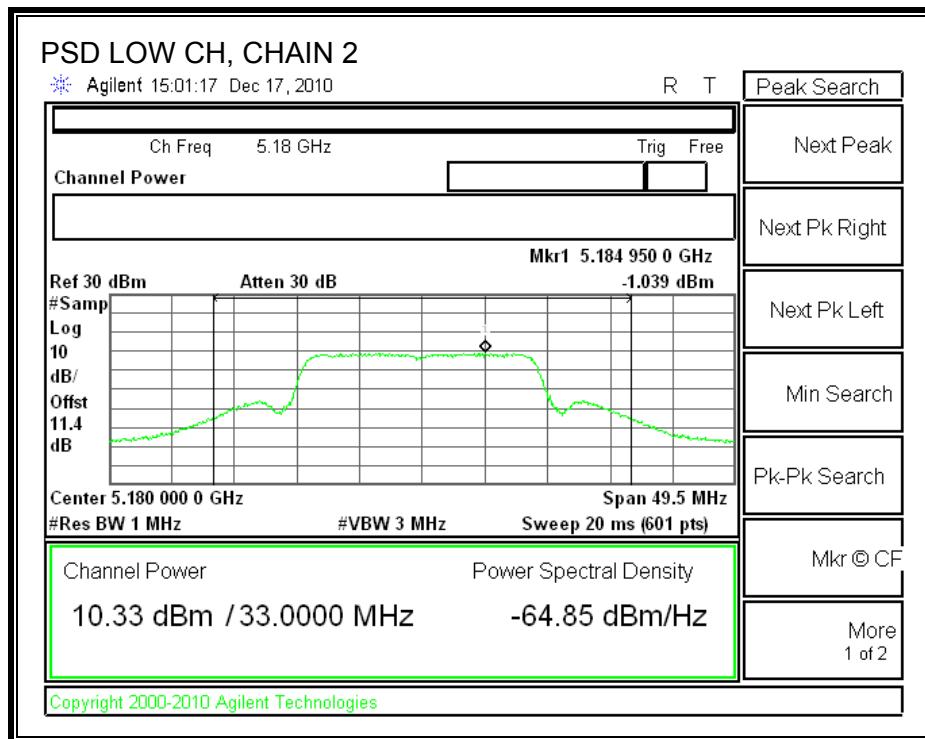
Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.062	-1.039	-0.993	3.74	3.98	-0.24
Middle	5200	-0.947	-1.008	-1.382	3.66	3.98	-0.32
High	5240	-0.954	-1.075	-1.428	3.62	3.98	-0.36

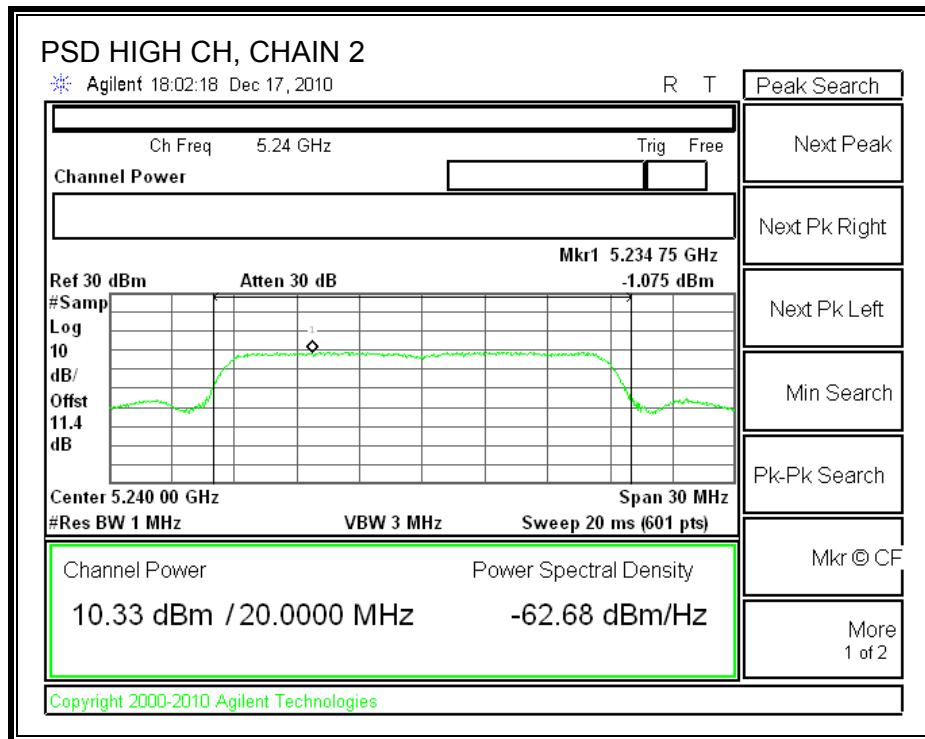
CHAIN 1 POWER SPECTRAL DENSITY



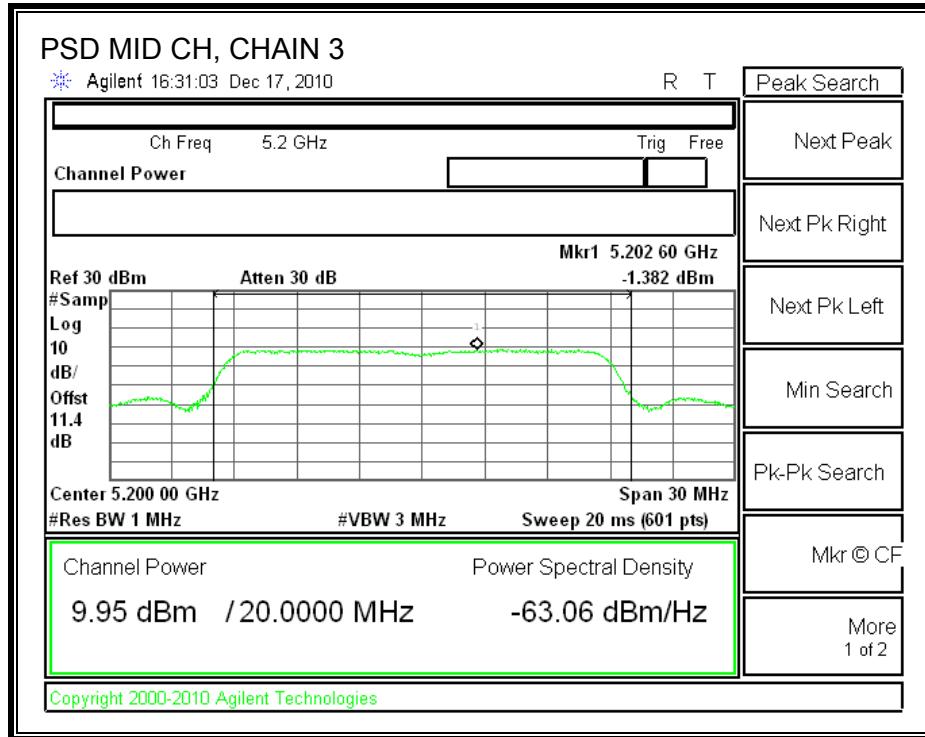
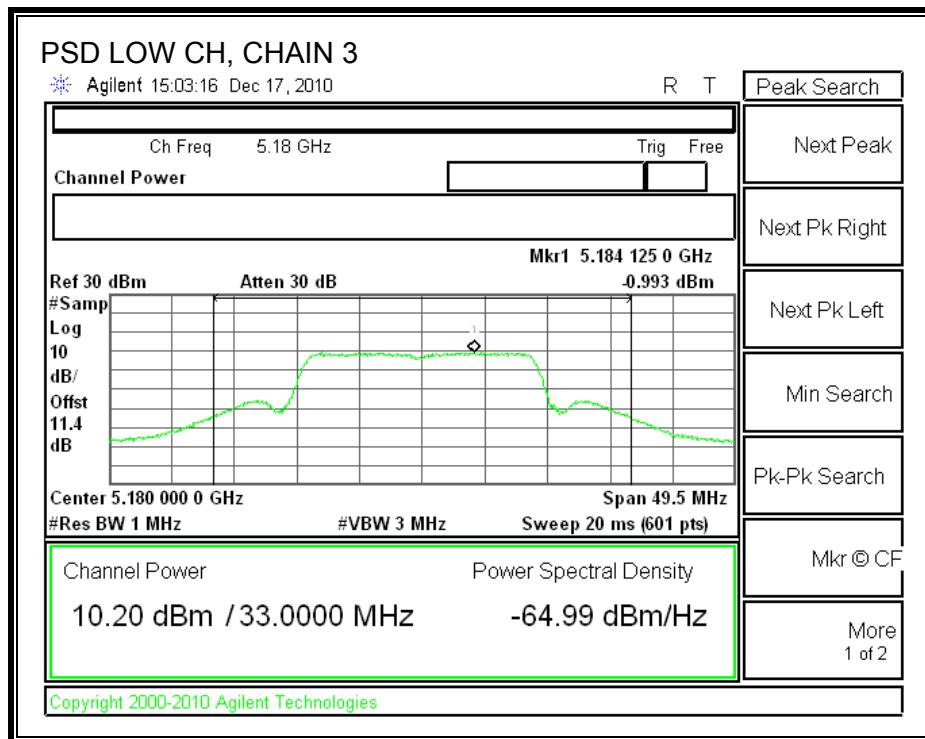


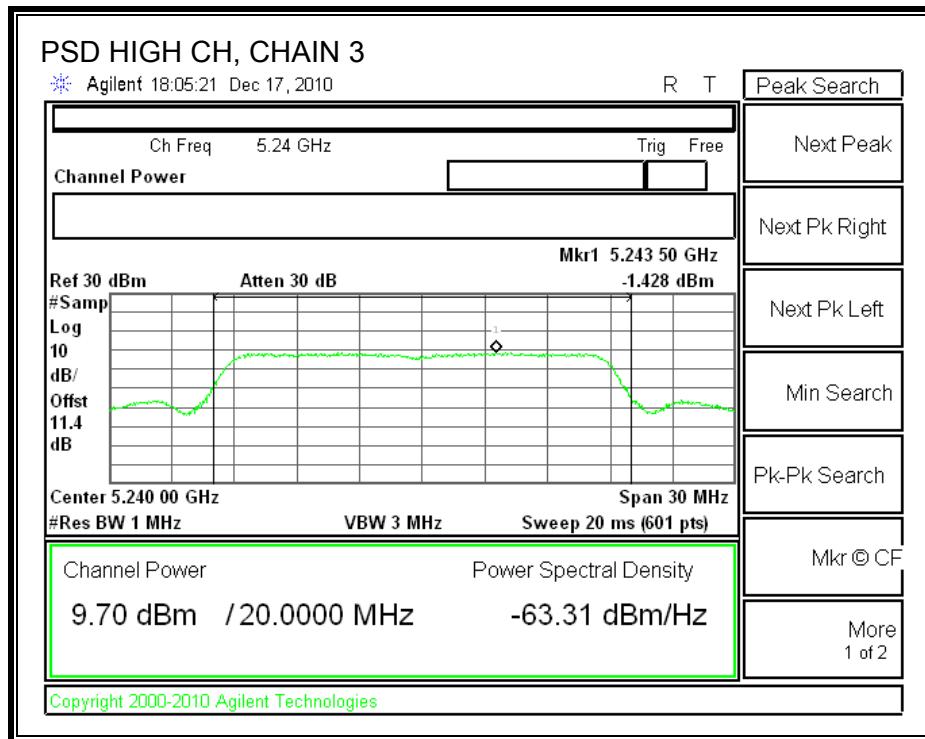
CHAIN 2 POWER SPECTRAL DENSITY





CHAIN 3 POWER SPECTRAL DENSITY





7.2.19. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

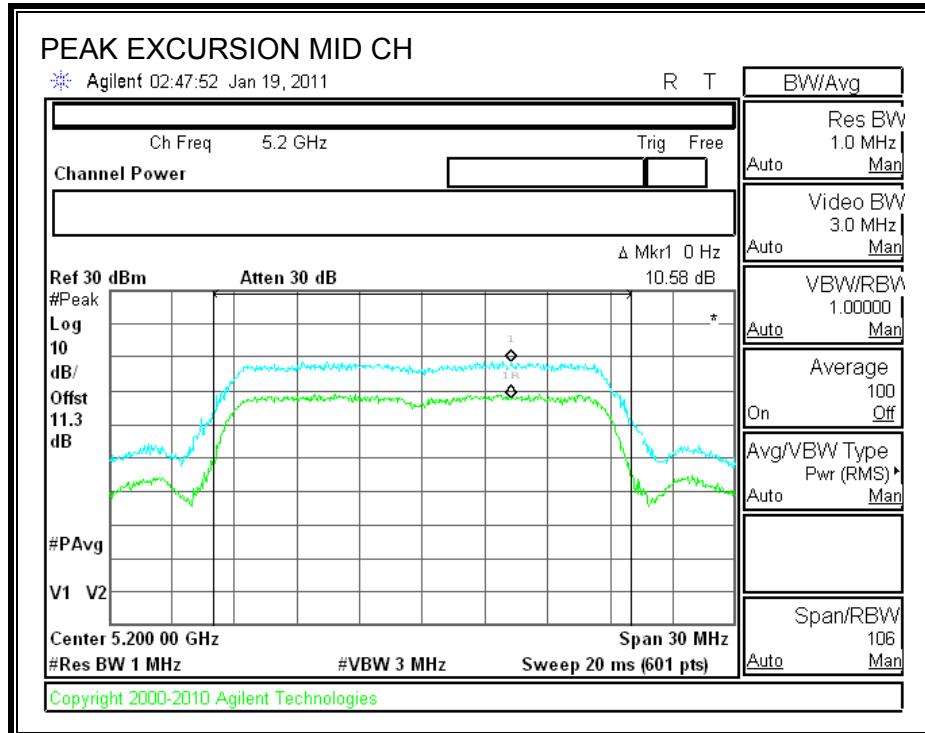
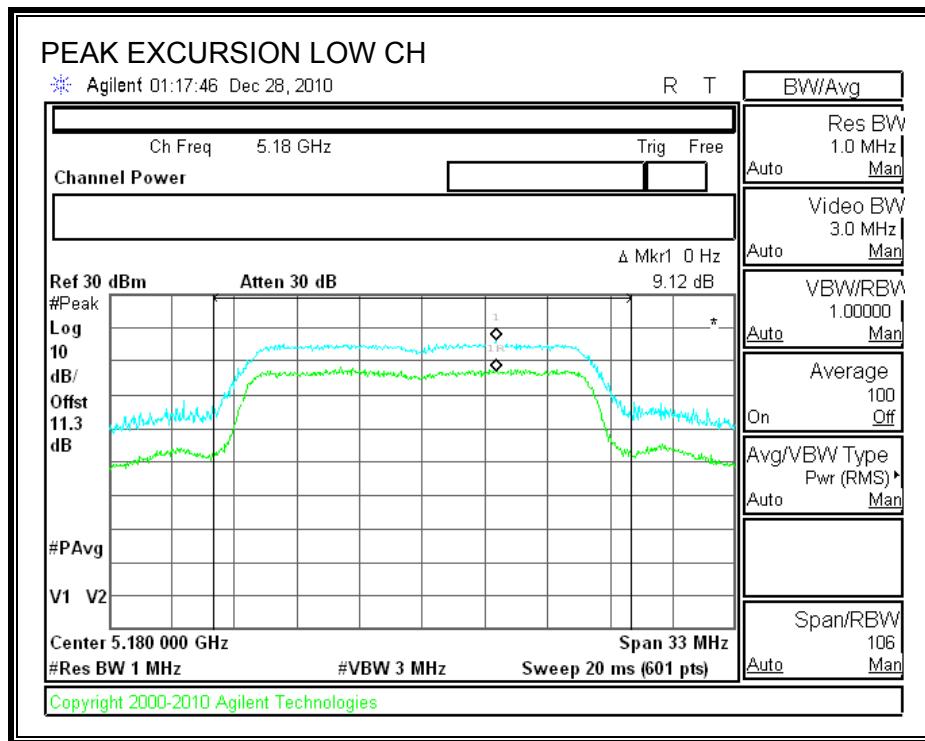
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

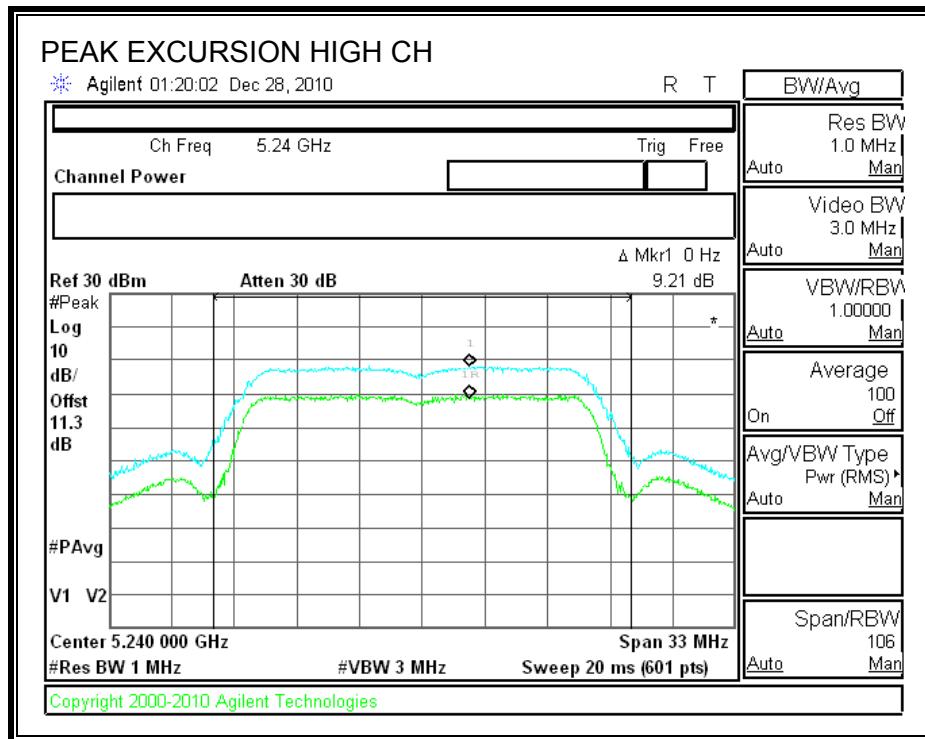
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	9.12	13	-3.88
Middle	5200	10.58	13	-2.42
High	5240	9.21	13	-3.79

PEAK EXCURSION





7.2.20. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

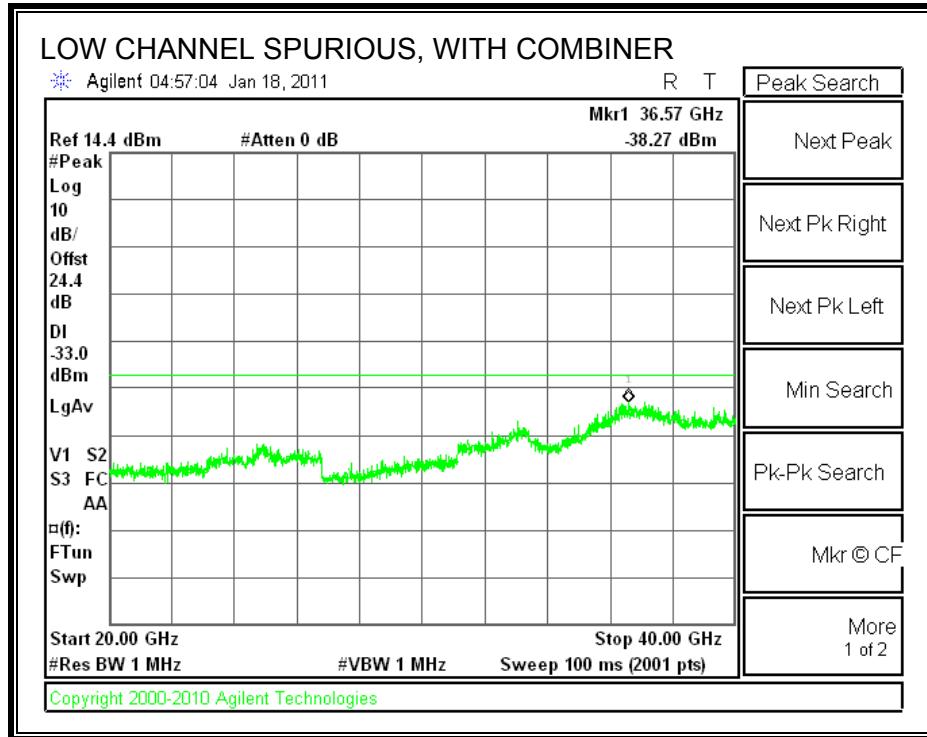
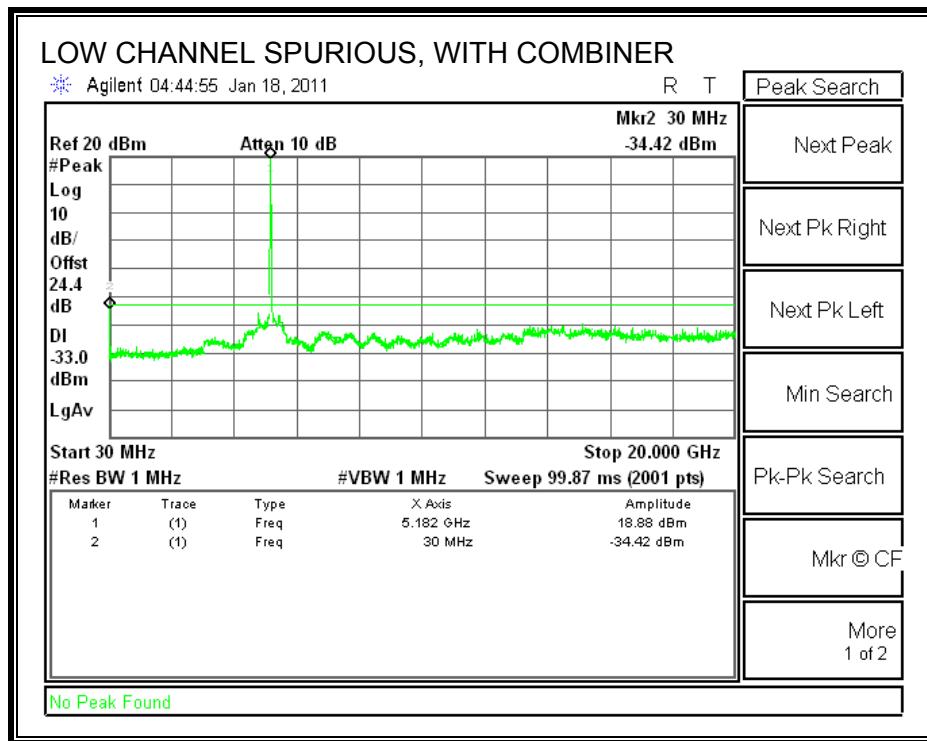
TEST PROCEDURE

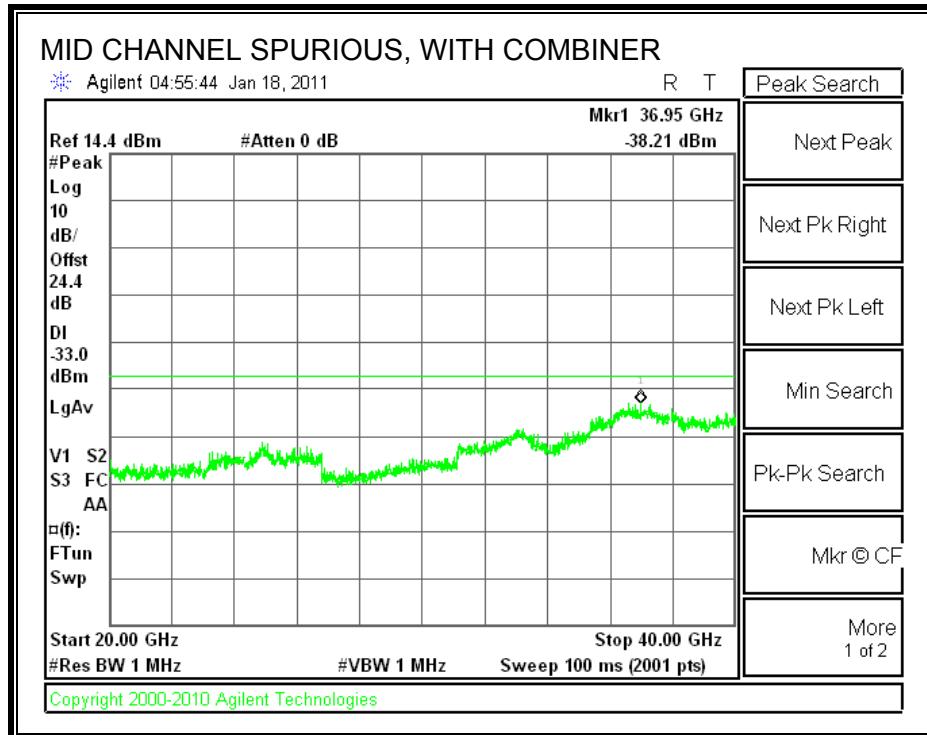
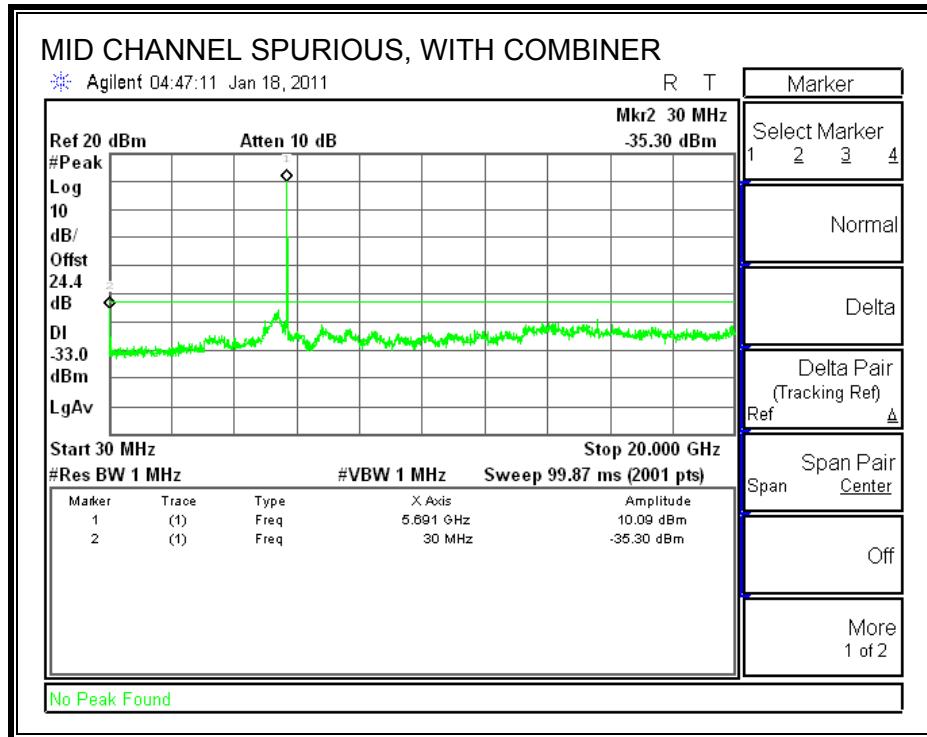
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

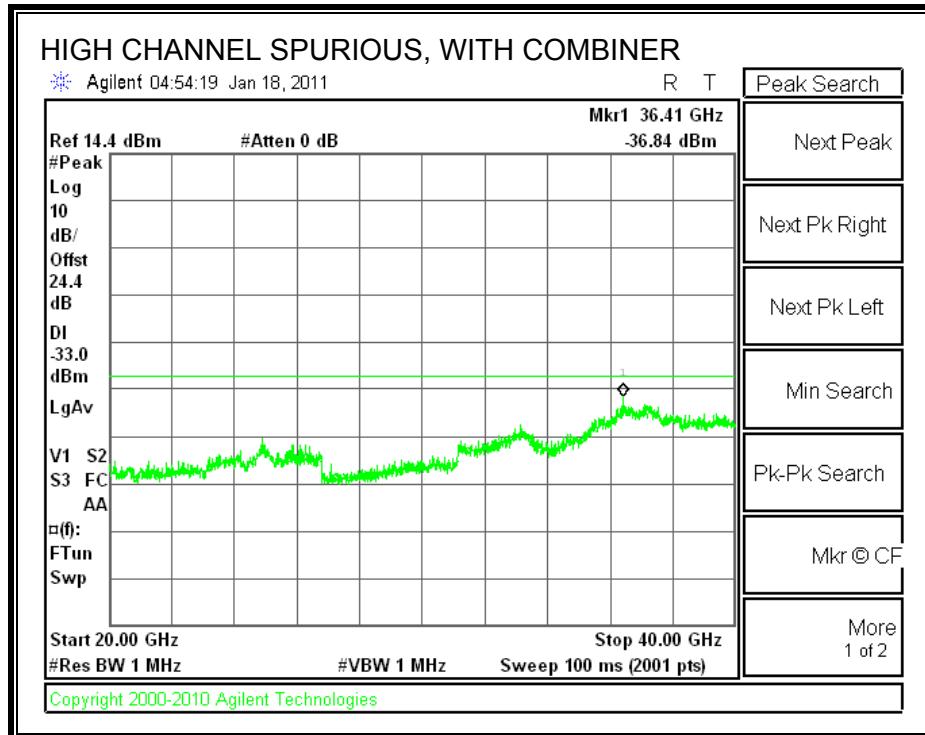
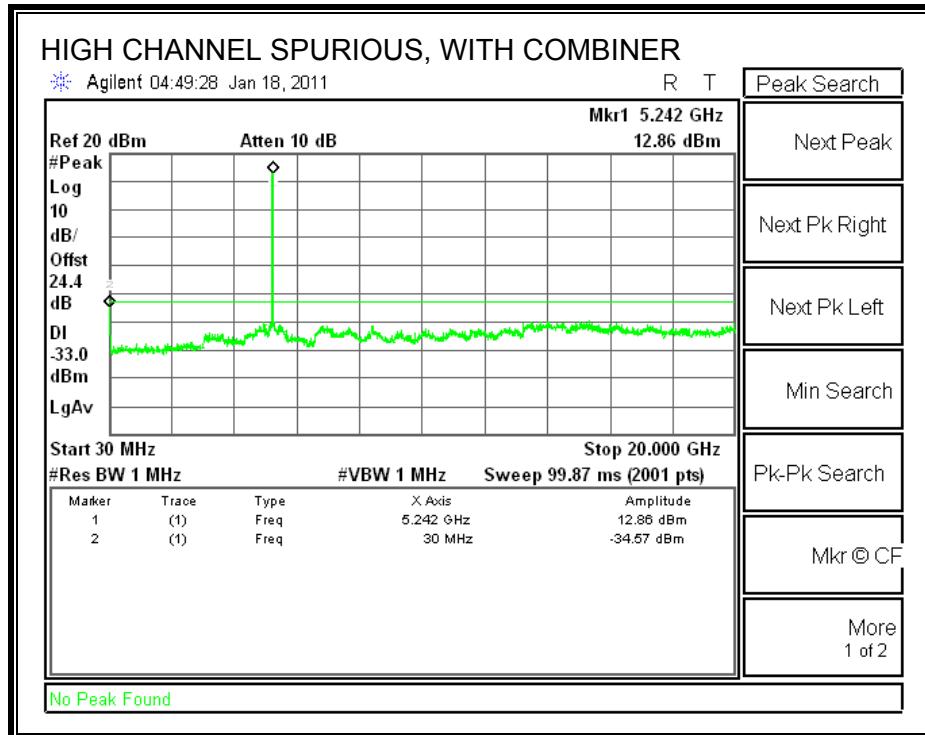
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER







SDM MCS21

7.2.21. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

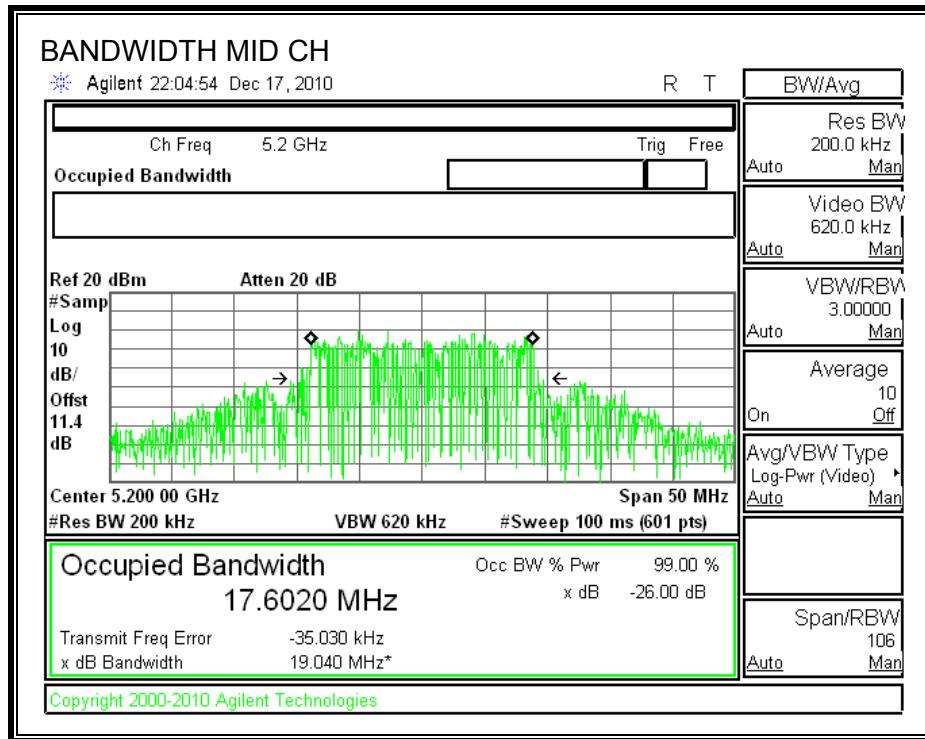
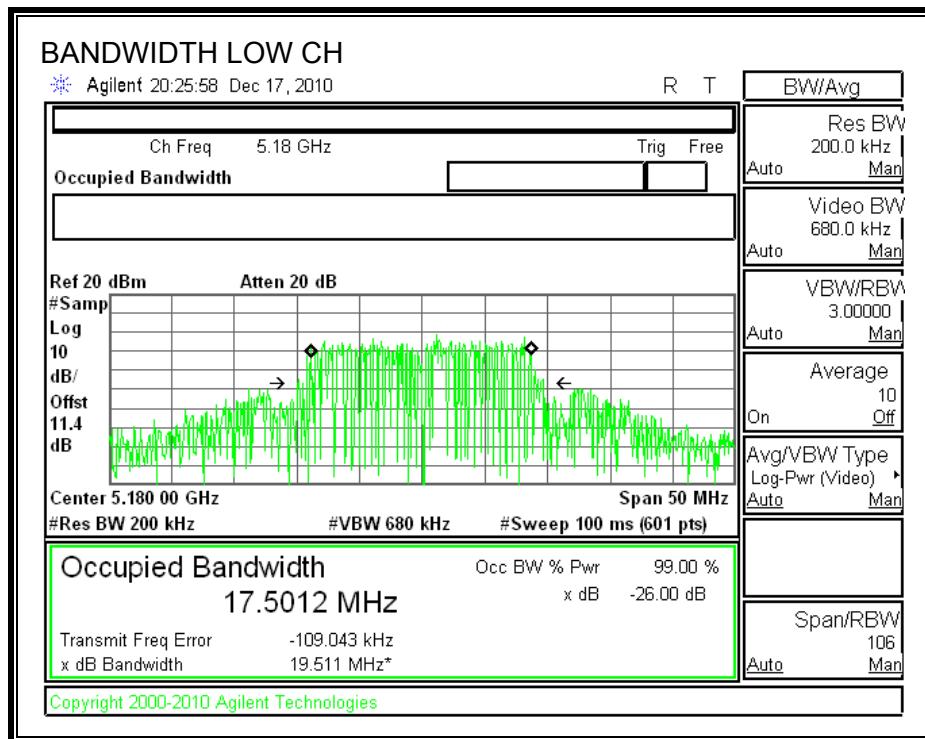
TEST PROCEDURE

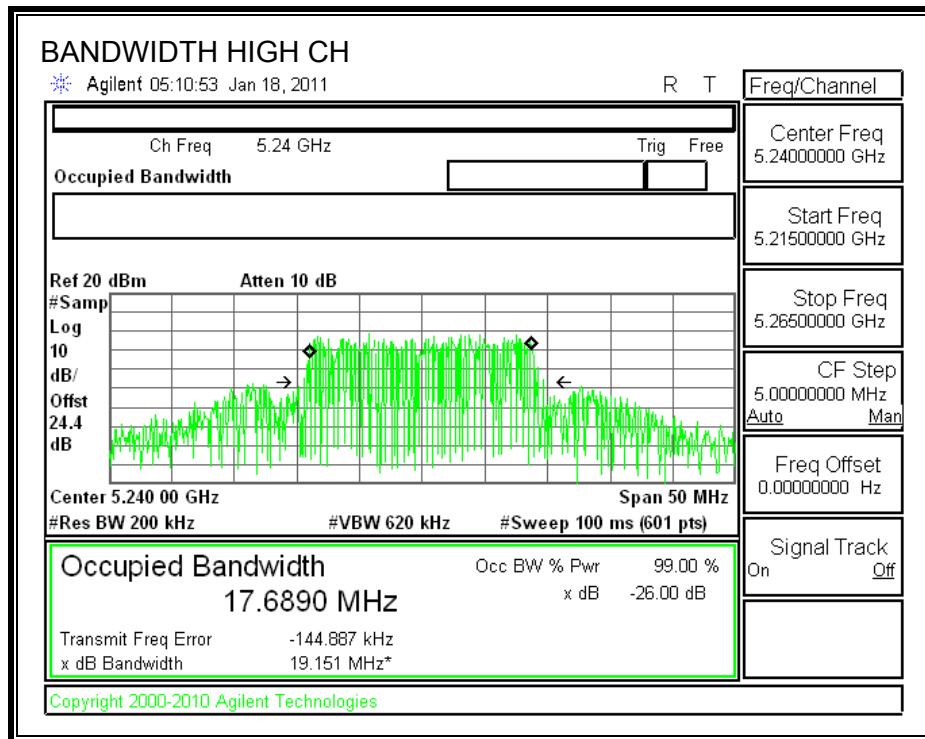
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.511	17.5012
Middle	5200	19.040	17.6020
High	5240	19.151	17.689

26 dB and 99% BANDWIDTH





7.2.22. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

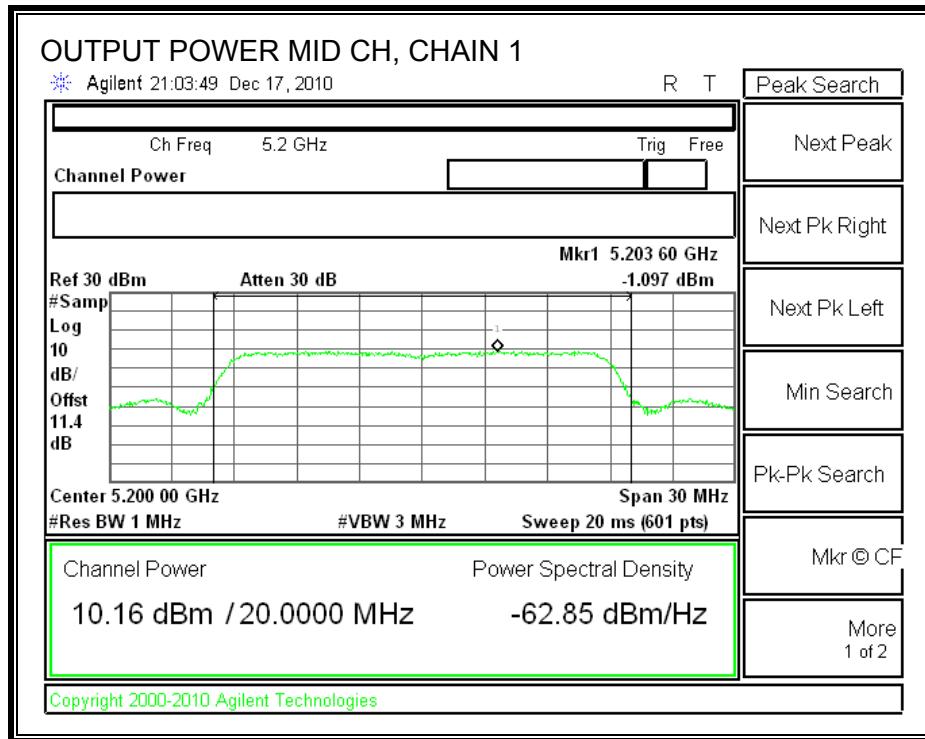
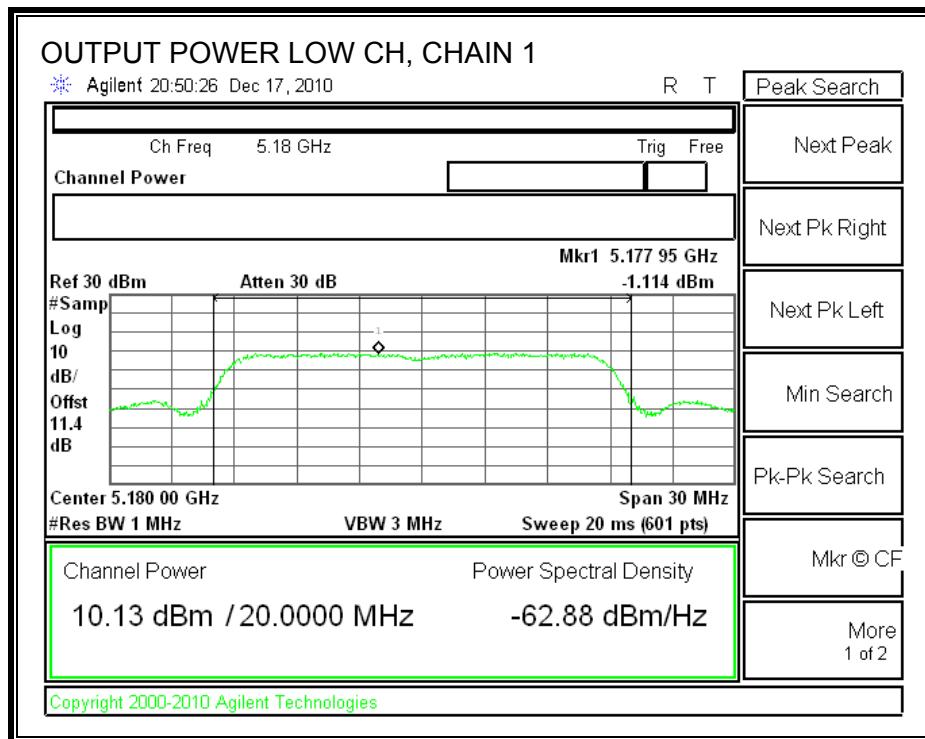
Limit

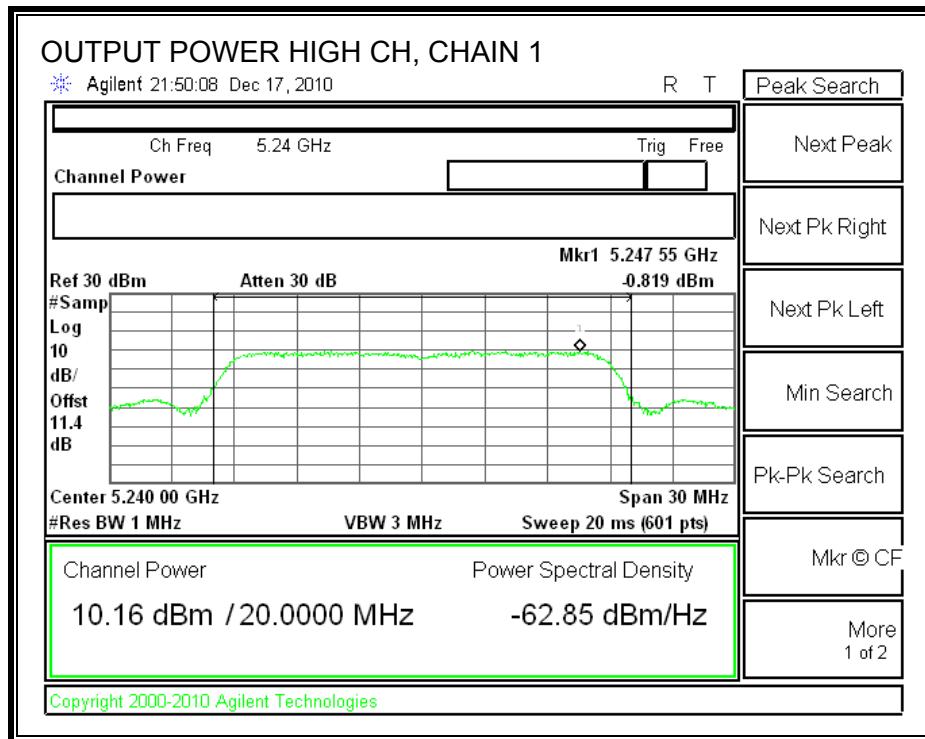
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.511	16.90	6.02	16.88
Mid	5200	16.99	19.040	16.80	6.02	16.78
High	5240	16.99	19.151	16.82	6.02	16.82

Individual Chain Results

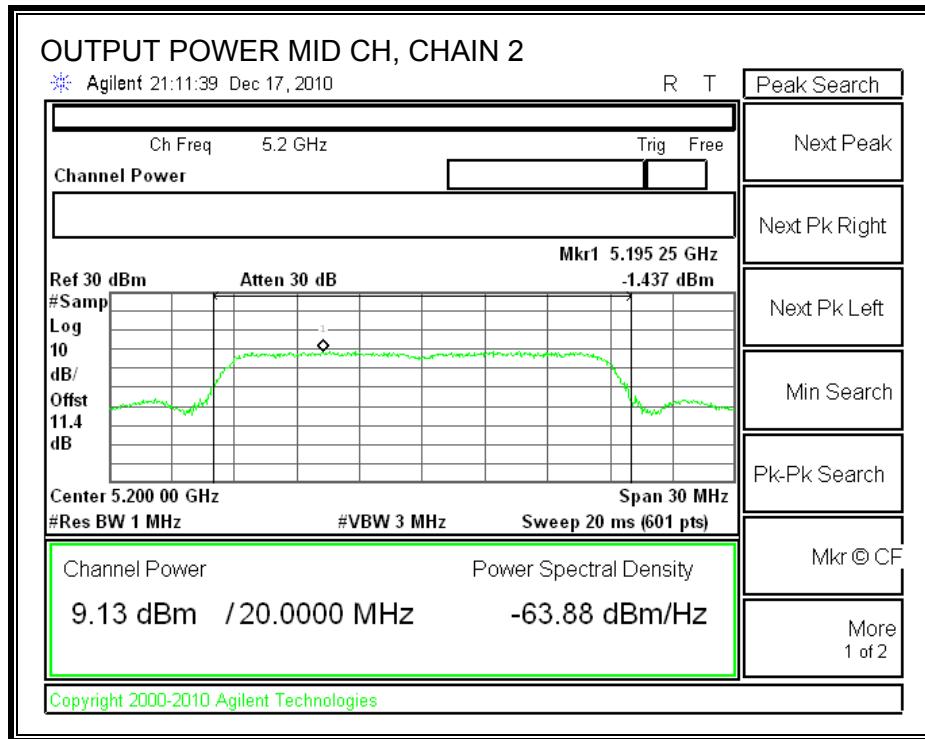
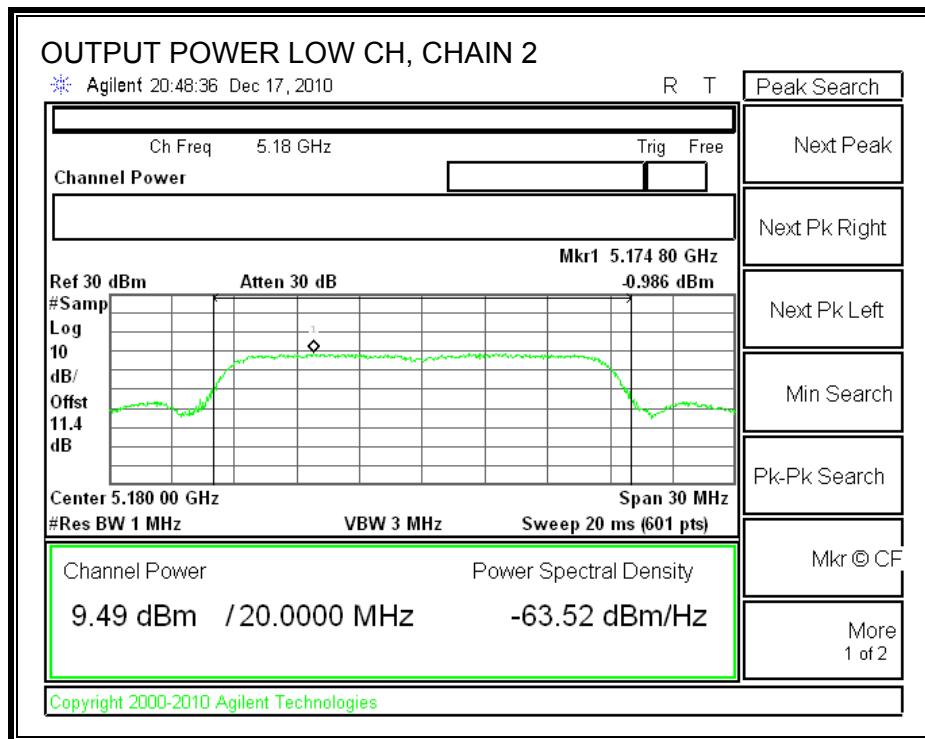
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	10.13	9.49	9.00	14.34	16.88	-2.55
Mid	5200	10.16	9.13	9.04	14.25	16.78	-2.53
High	5240	10.16	9.50	9.06	14.37	16.82	-2.45

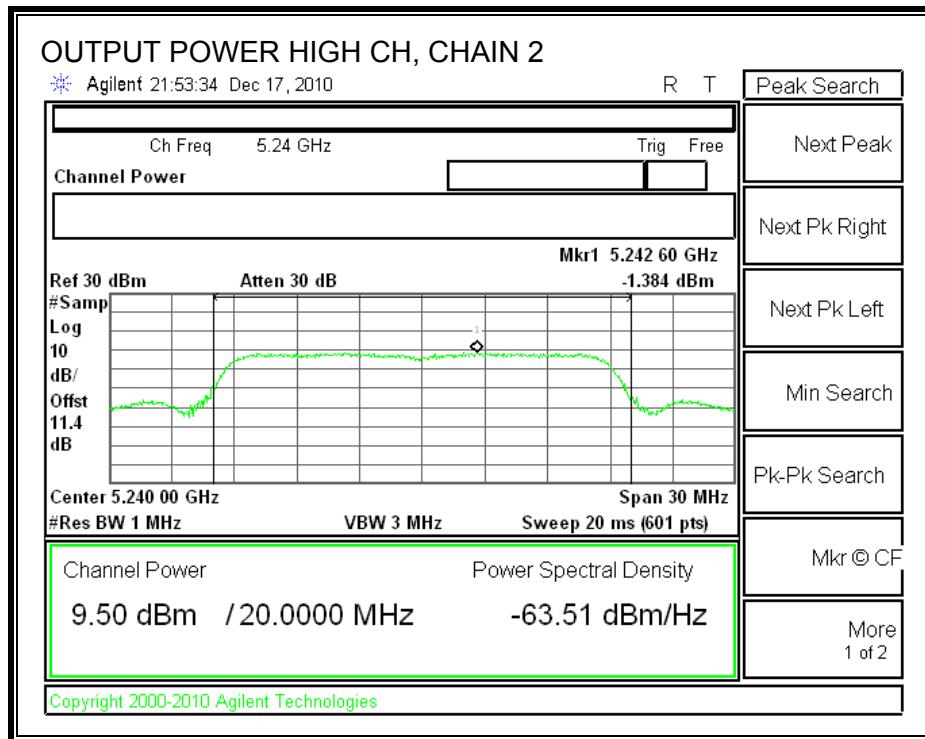
CHAIN 1 OUTPUT POWER



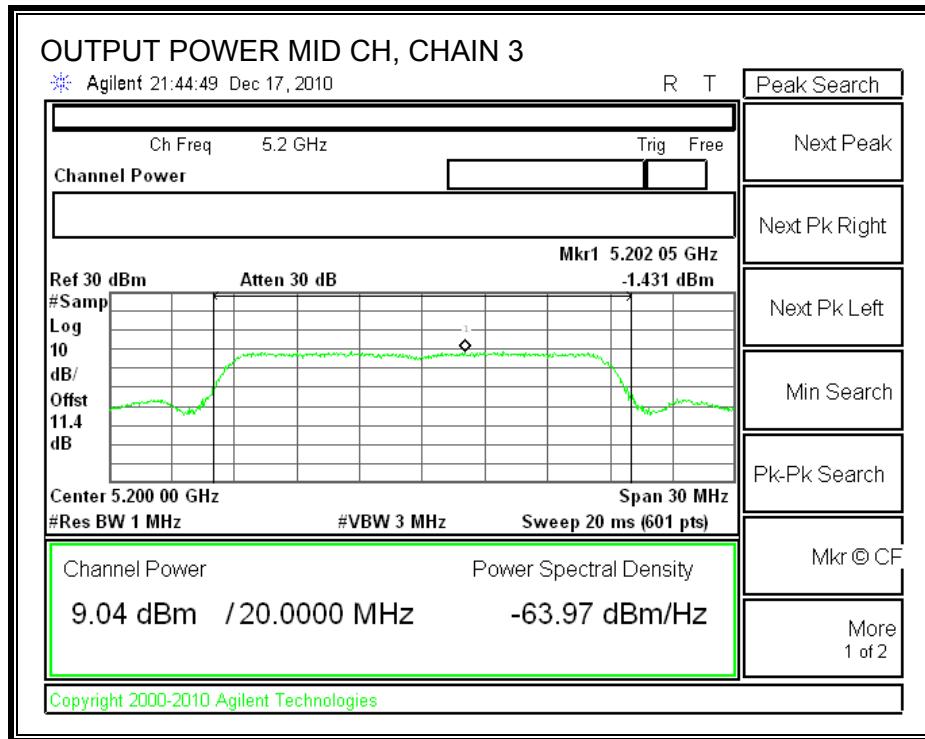
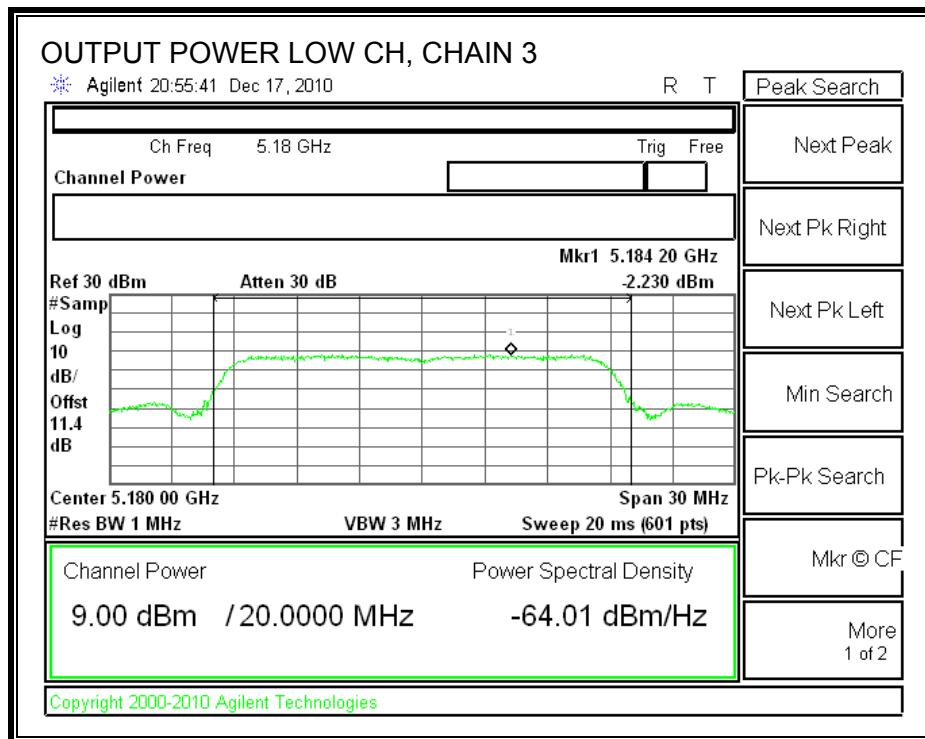


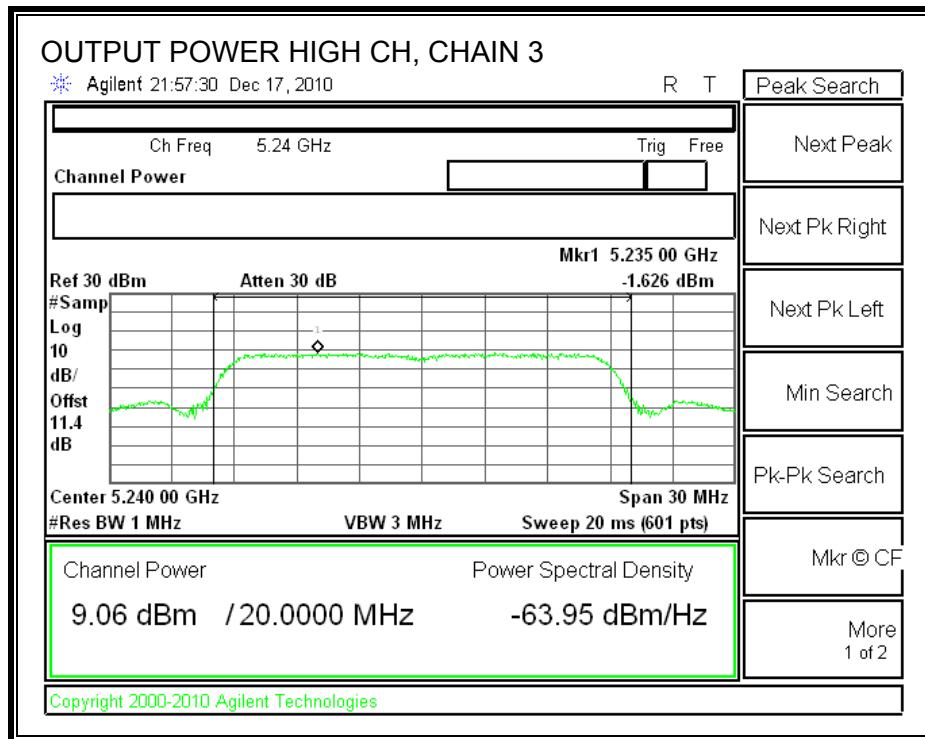
CHAIN 2 OUTPUT POWER





CHAIN 3 OUTPUT POWER





7.2.23. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is equal to 6.02 dBi, therefore the limit is 3.98 dBm.

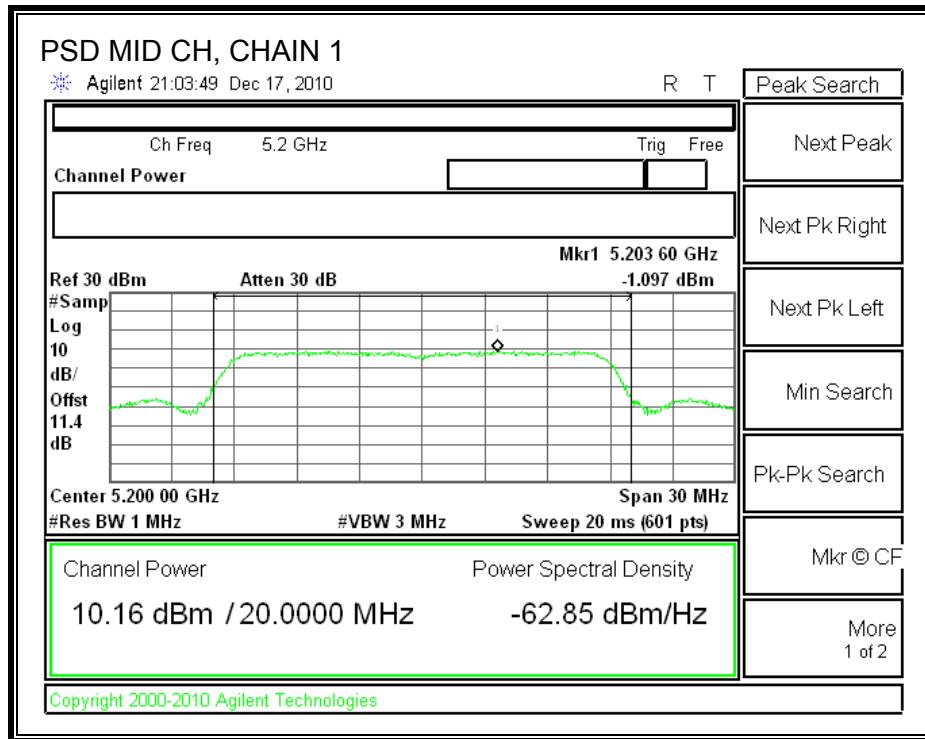
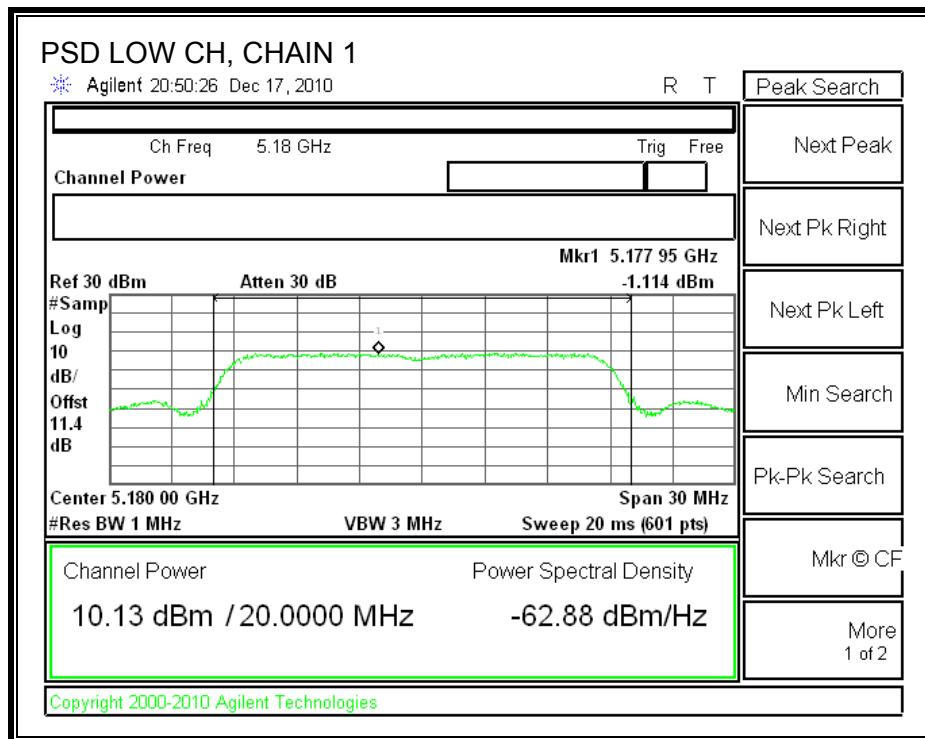
TEST PROCEDURE

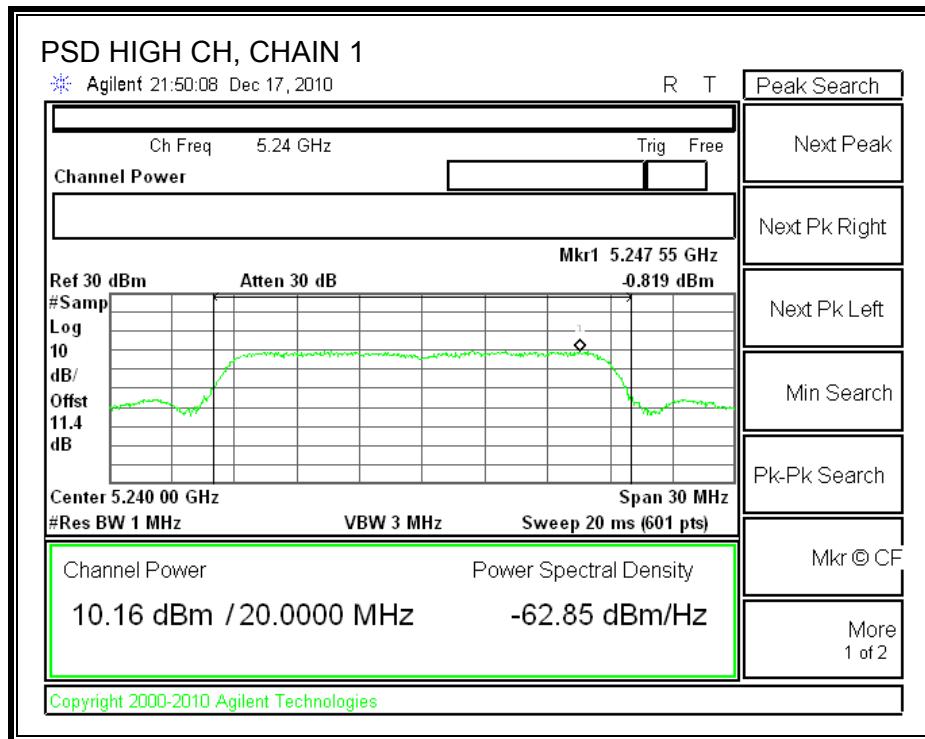
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

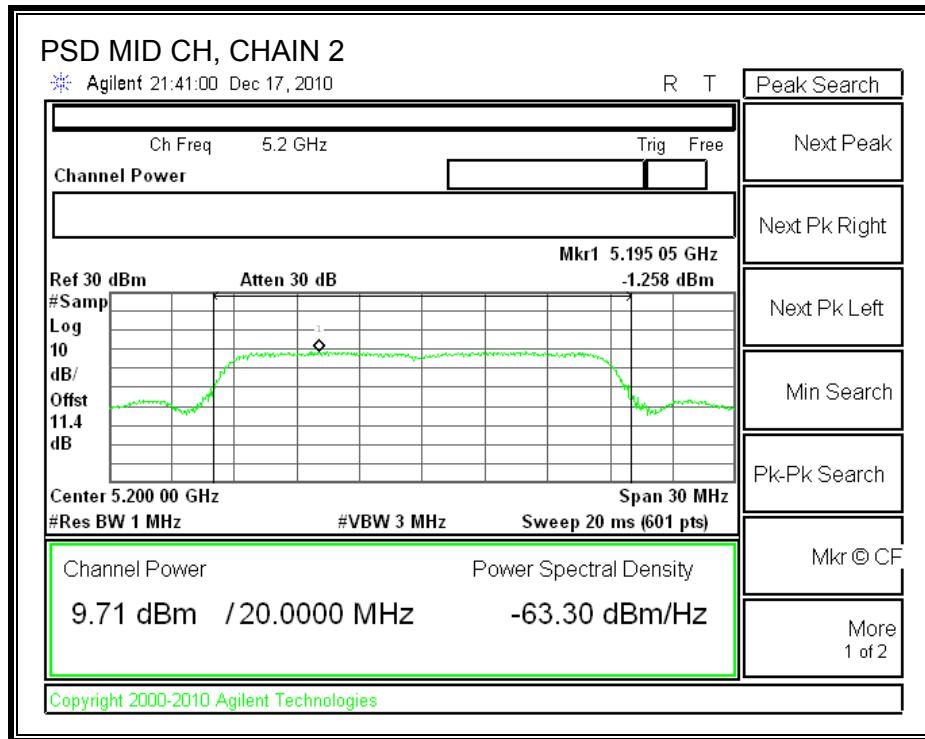
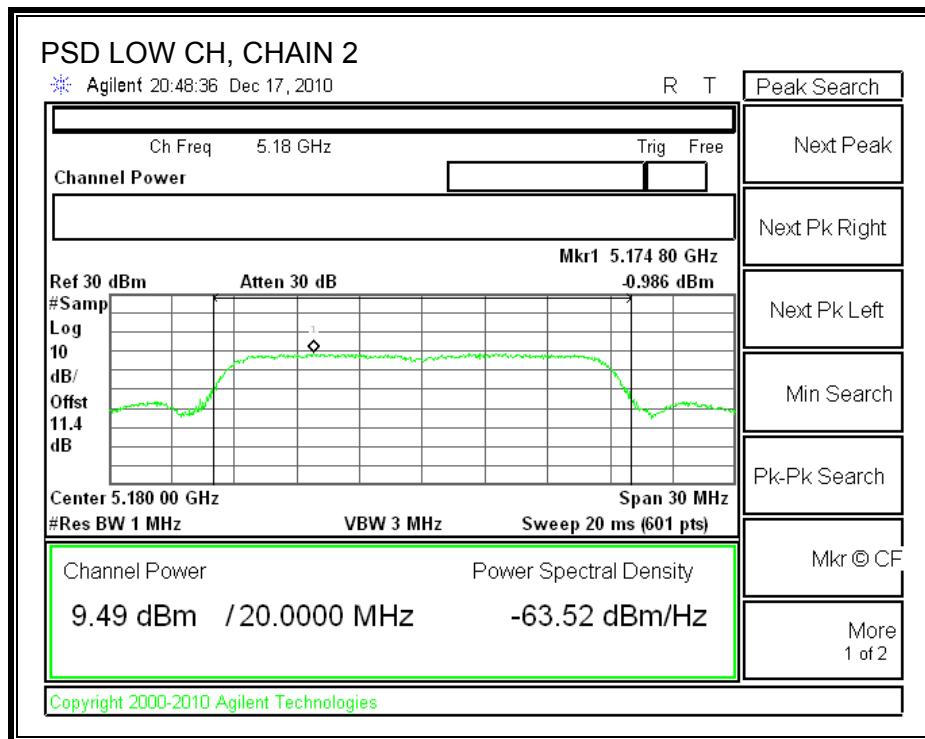
Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Chain 3 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5180	-1.114	-0.986	-2.23	3.36	3.98	-0.62
Middle	5200	-1.097	-1.258	-1.431	3.51	3.98	-0.47
High	5240	-0.819	-1.384	-1.626	3.51	3.98	-0.47

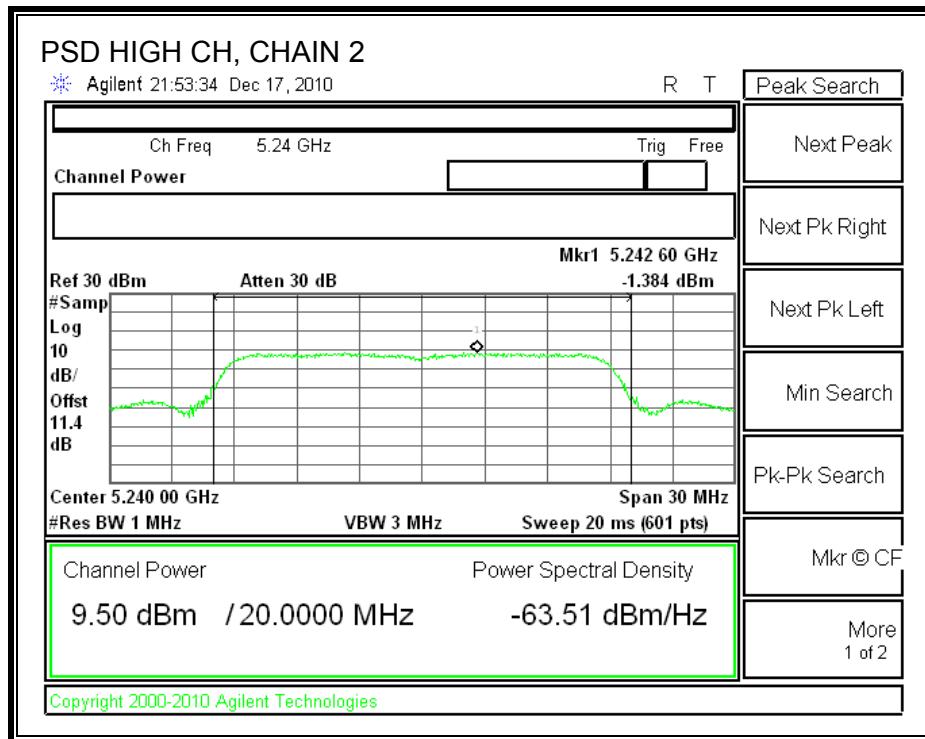
CHAIN 1 POWER SPECTRAL DENSITY



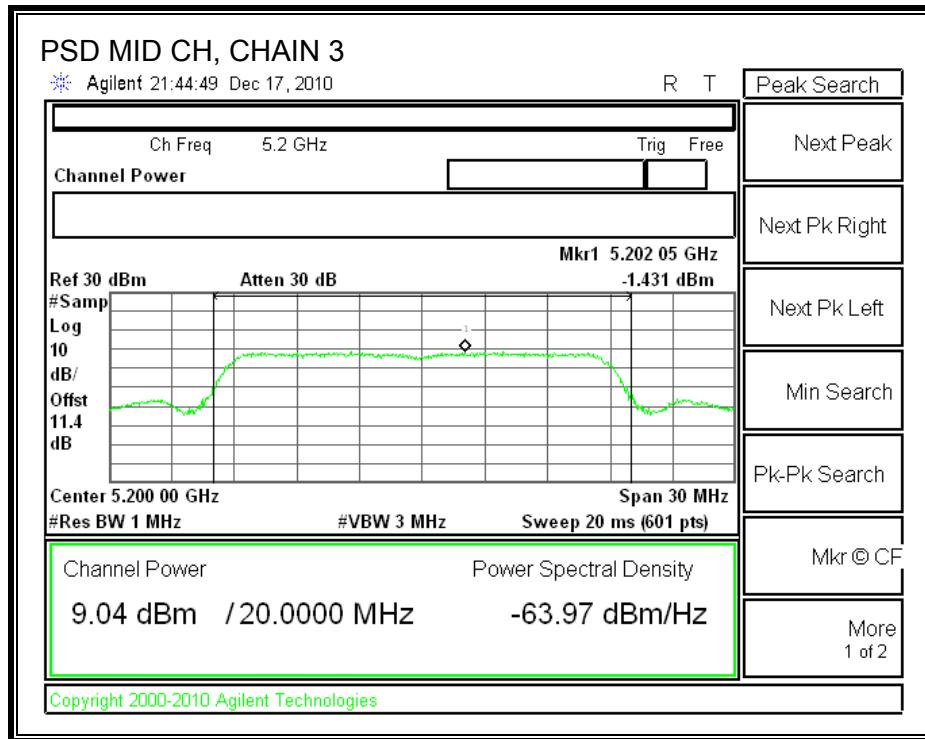
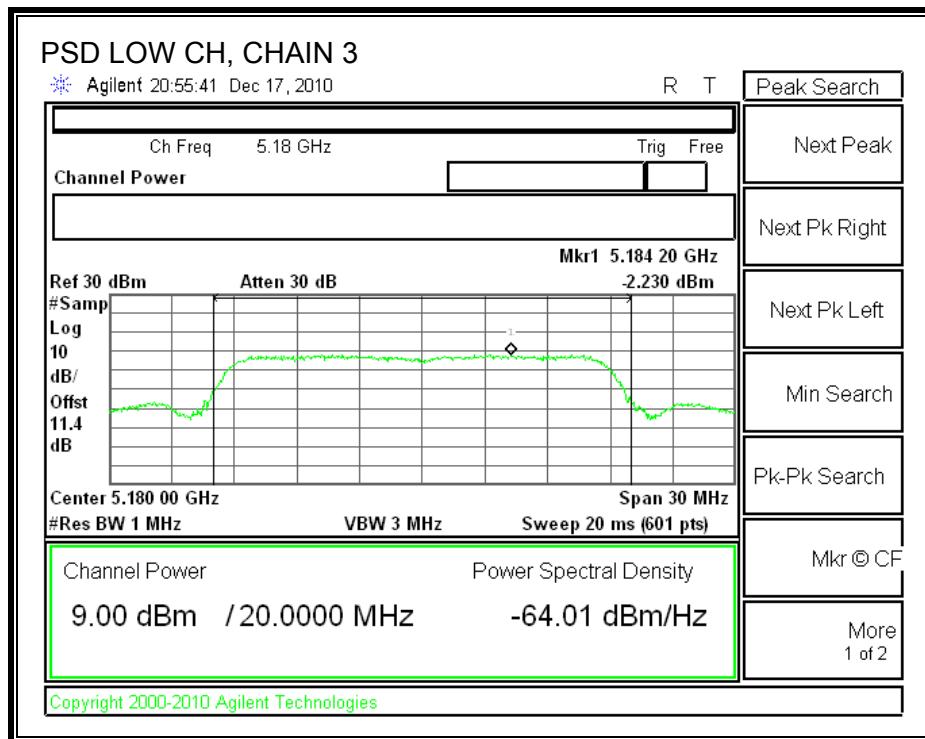


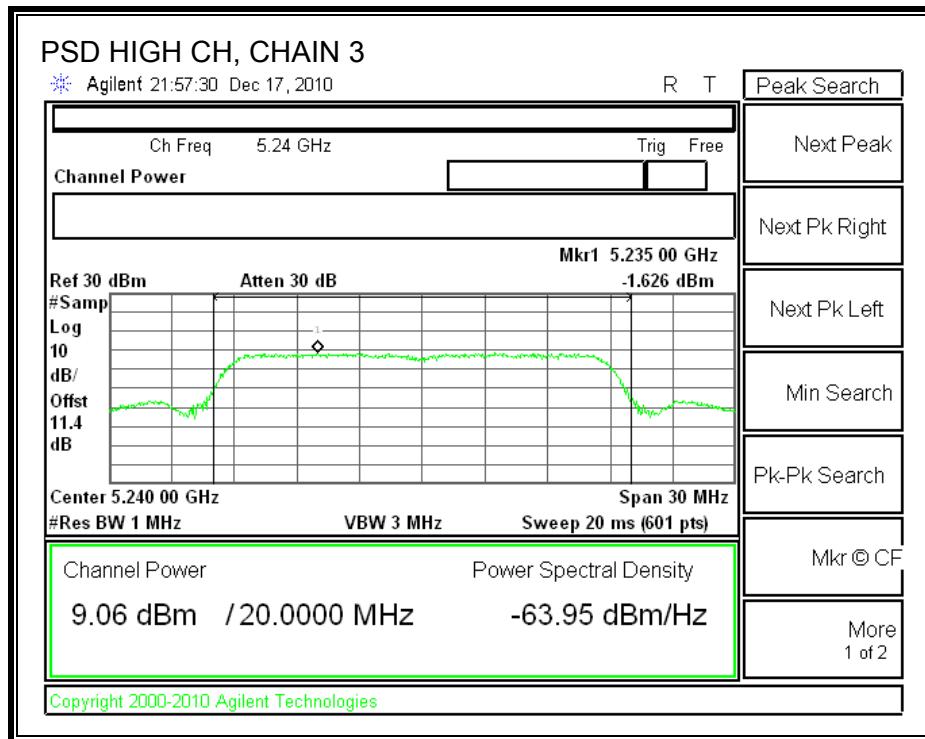
CHAIN 2 POWER SPECTRAL DENSITY





CHAIN 3 POWER SPECTRAL DENSITY





7.2.24. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

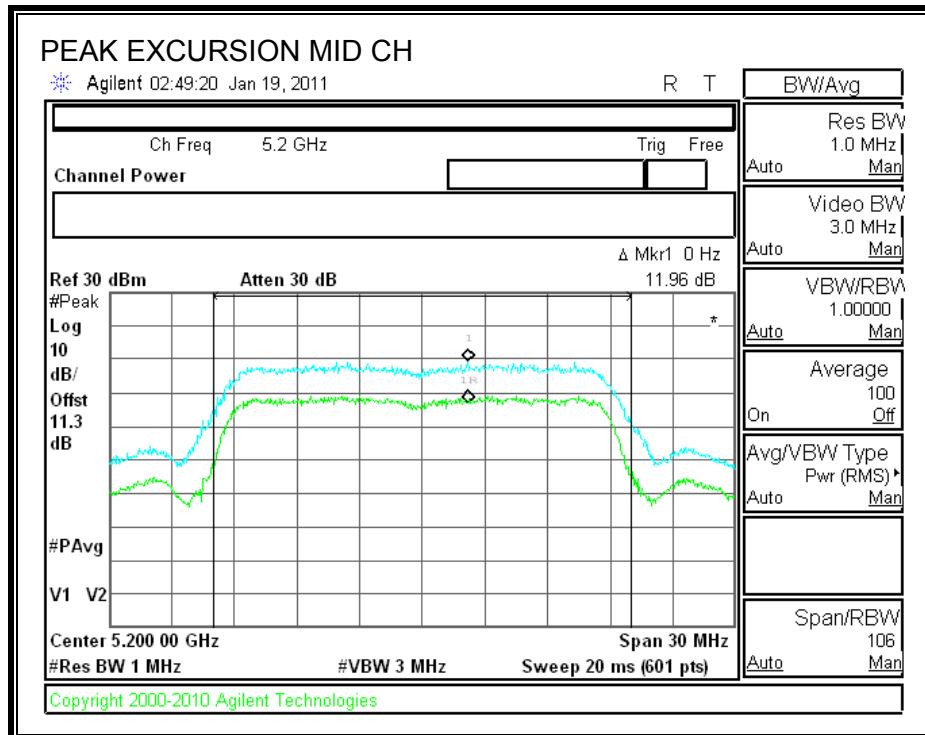
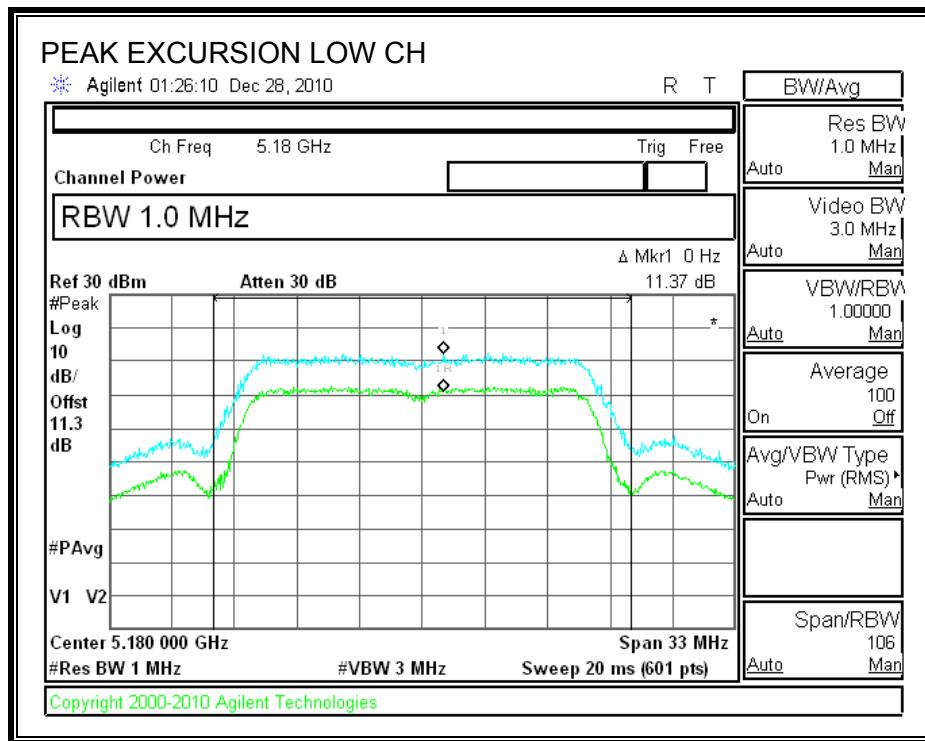
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

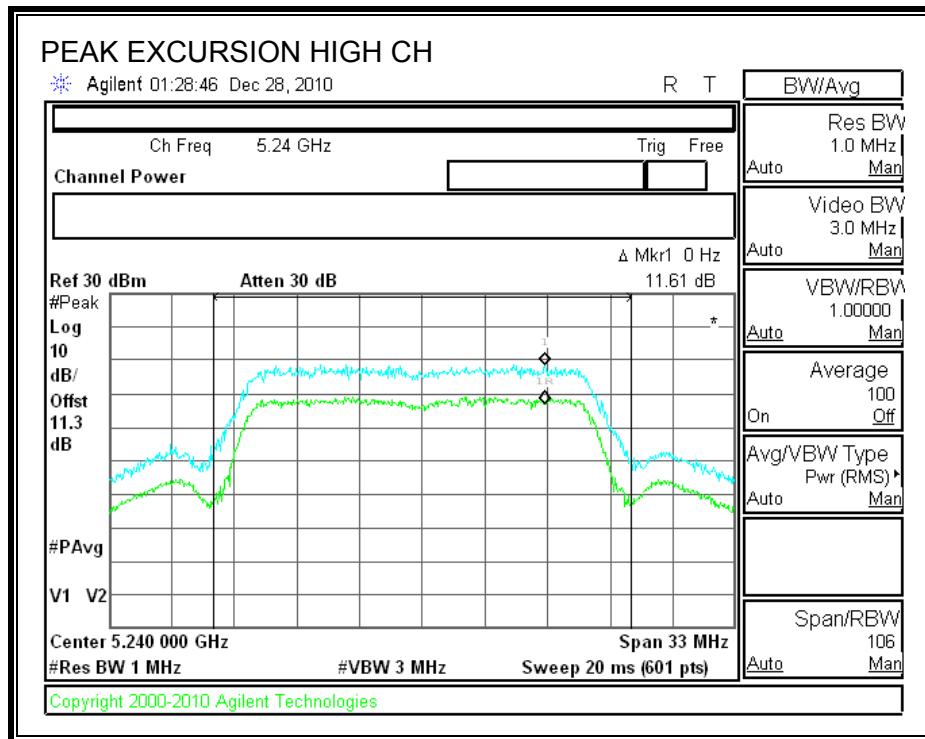
Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5180	11.37	13	-1.63
Middle	5200	11.96	13	-1.04
High	5240	11.61	13	-1.39

PEAK EXCURSION





7.2.25. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

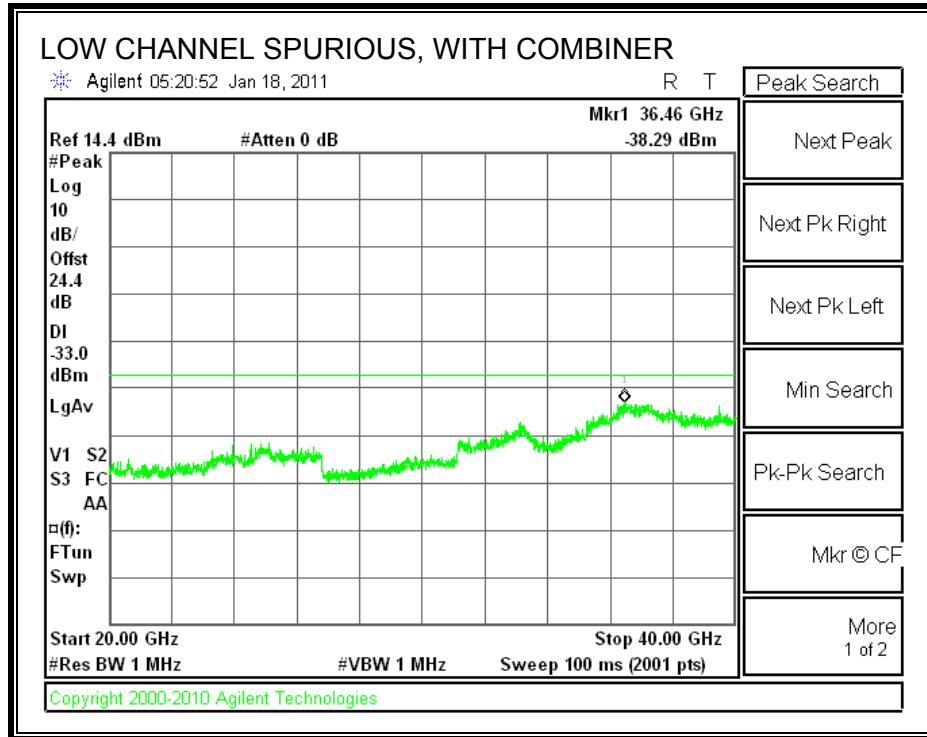
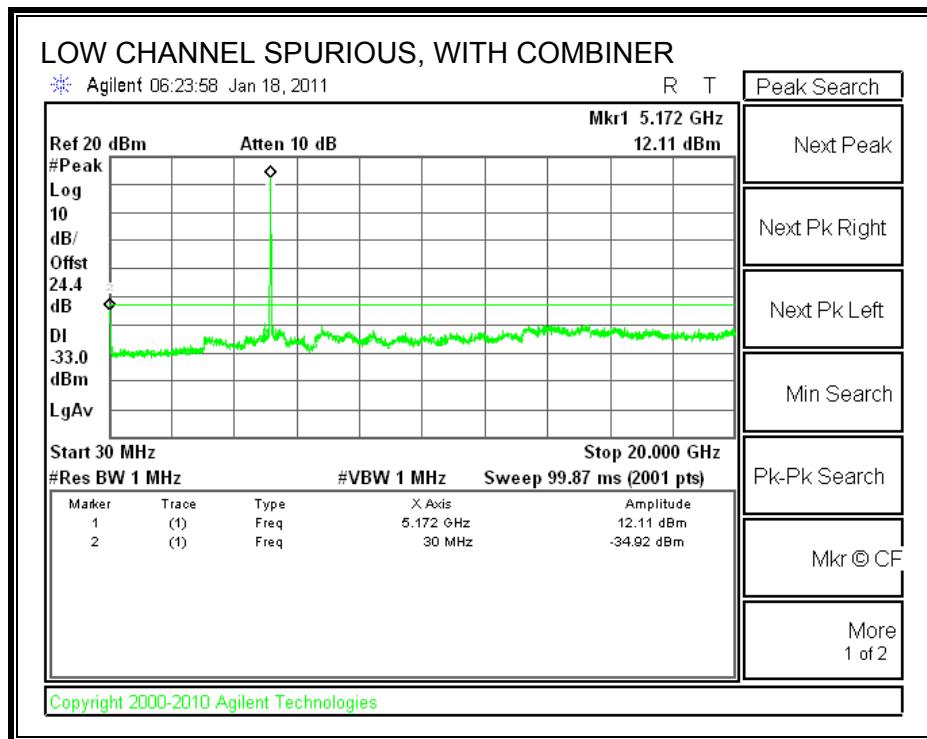
TEST PROCEDURE

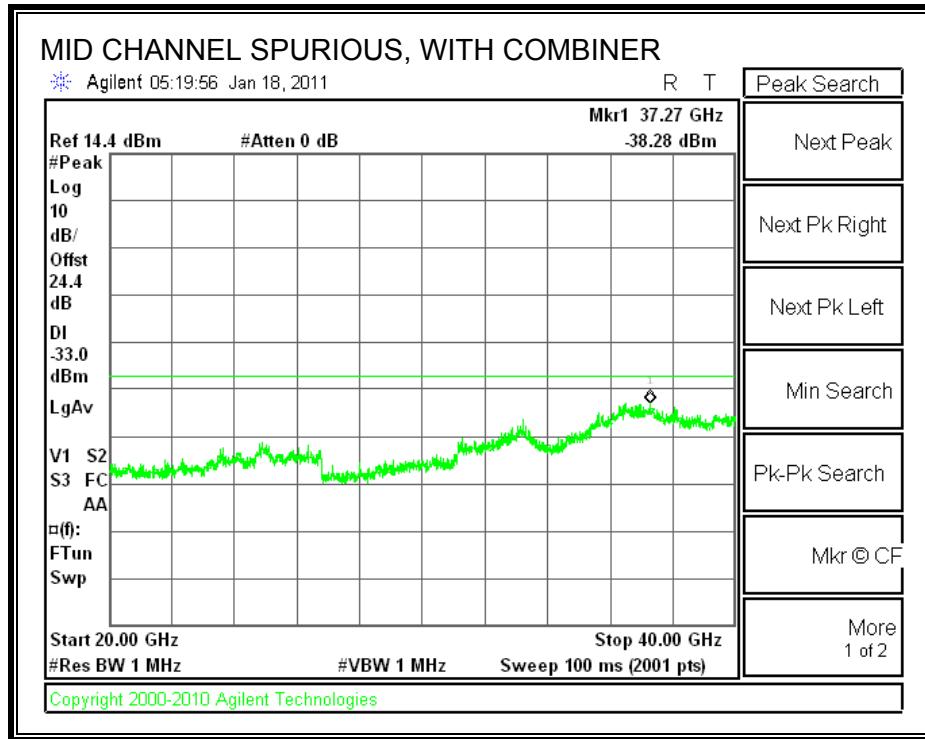
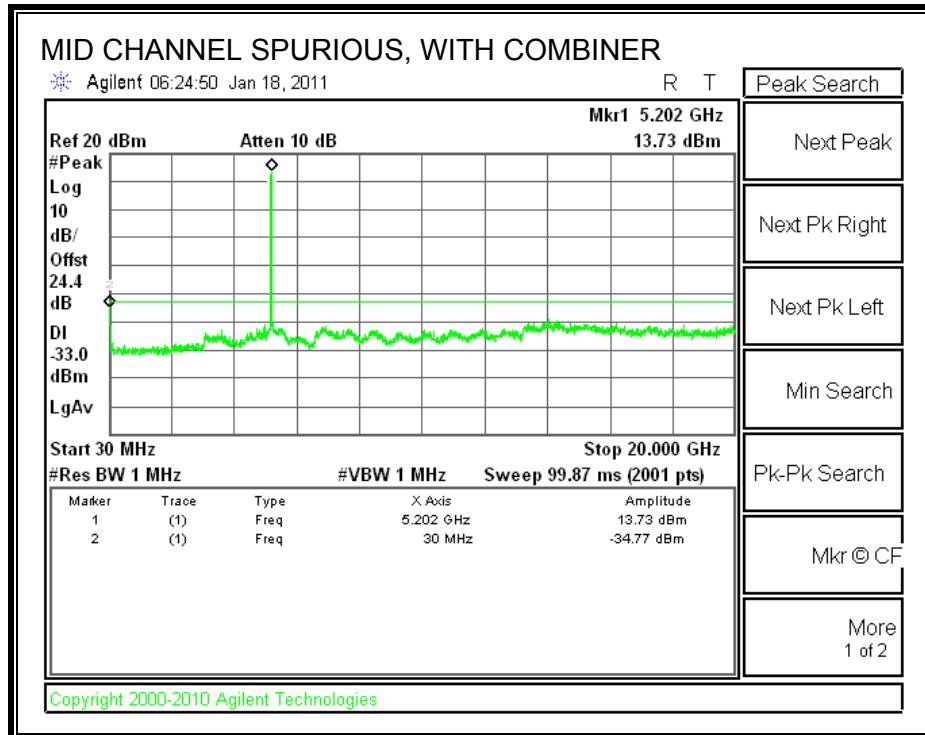
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

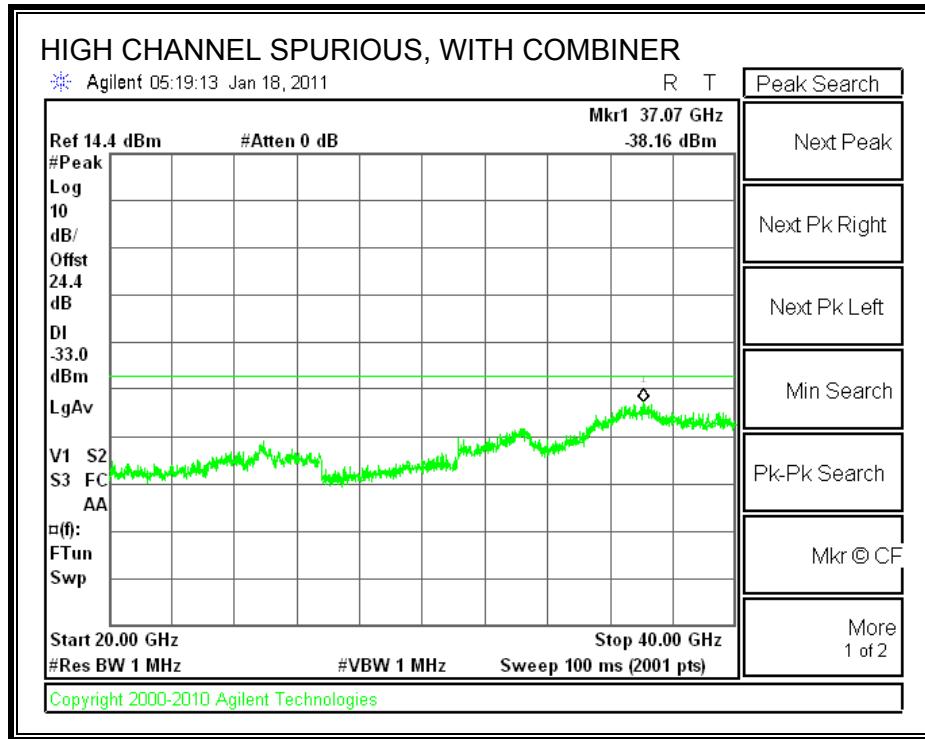
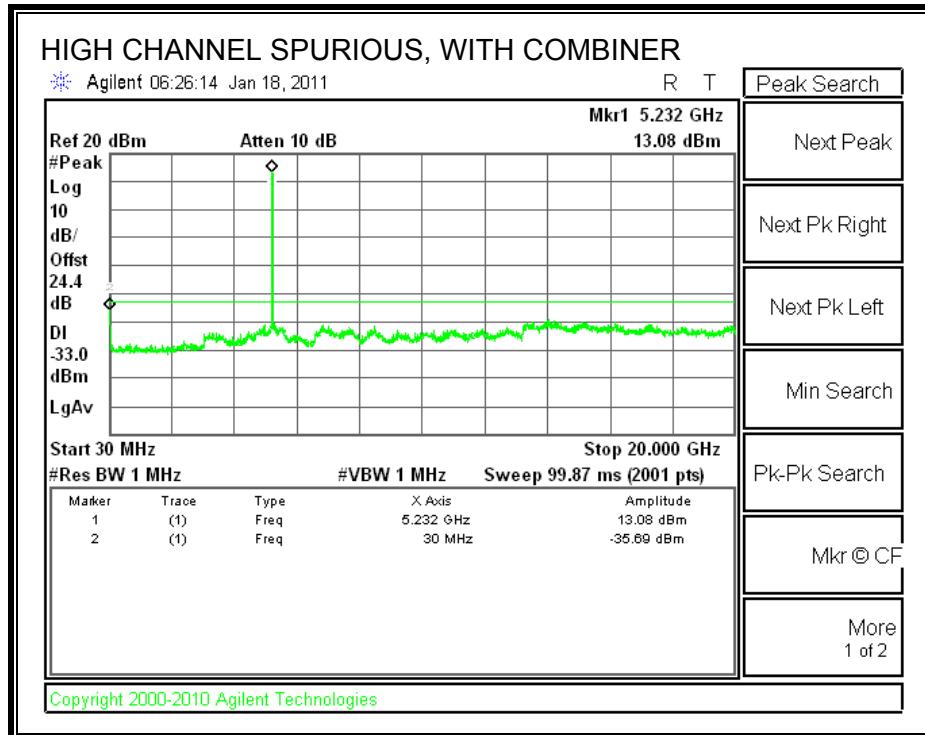
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER







7.3. 802.1n HT40 SISO MODE IN THE 5.2 GHz BAND

SISO

7.3.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

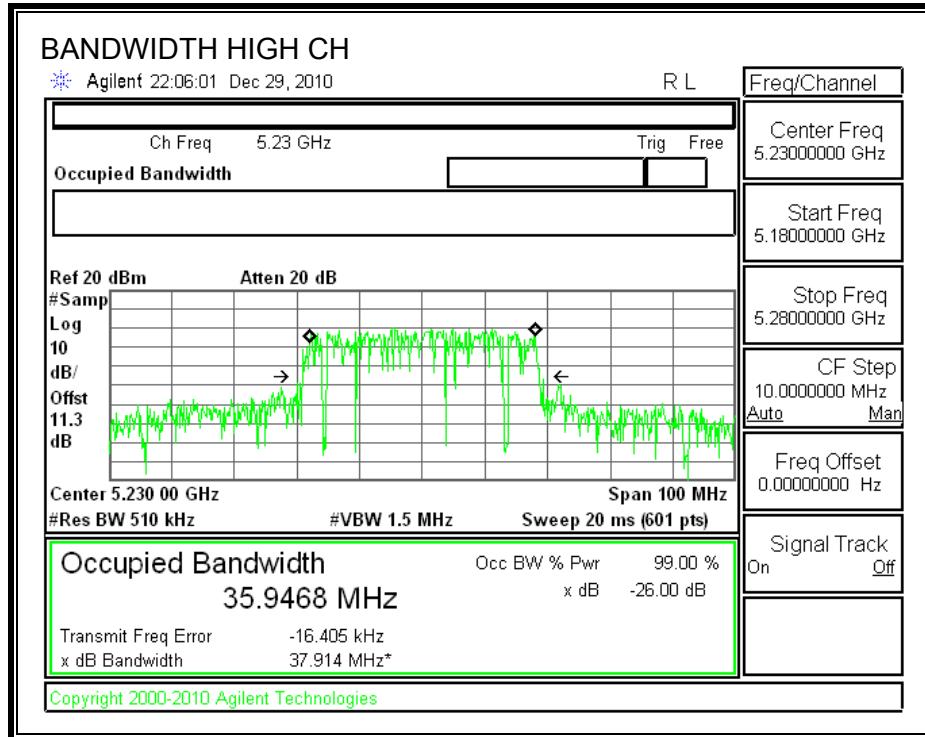
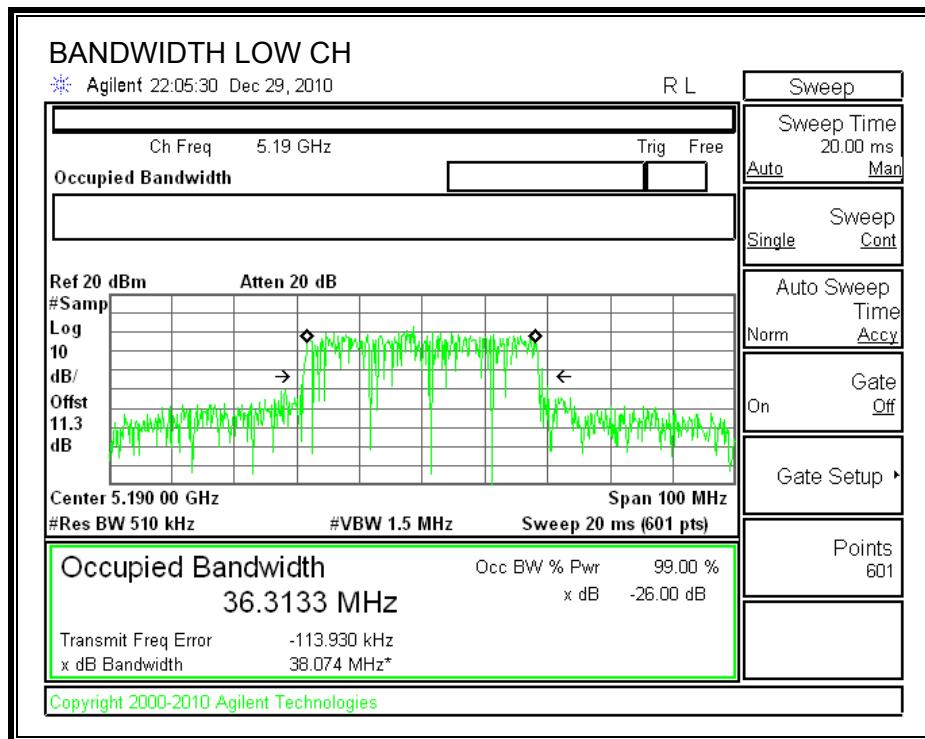
TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	38.074	36.3133
High	5230	37.914	35.9468

26 dB and 99% BANDWIDTH



7.3.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

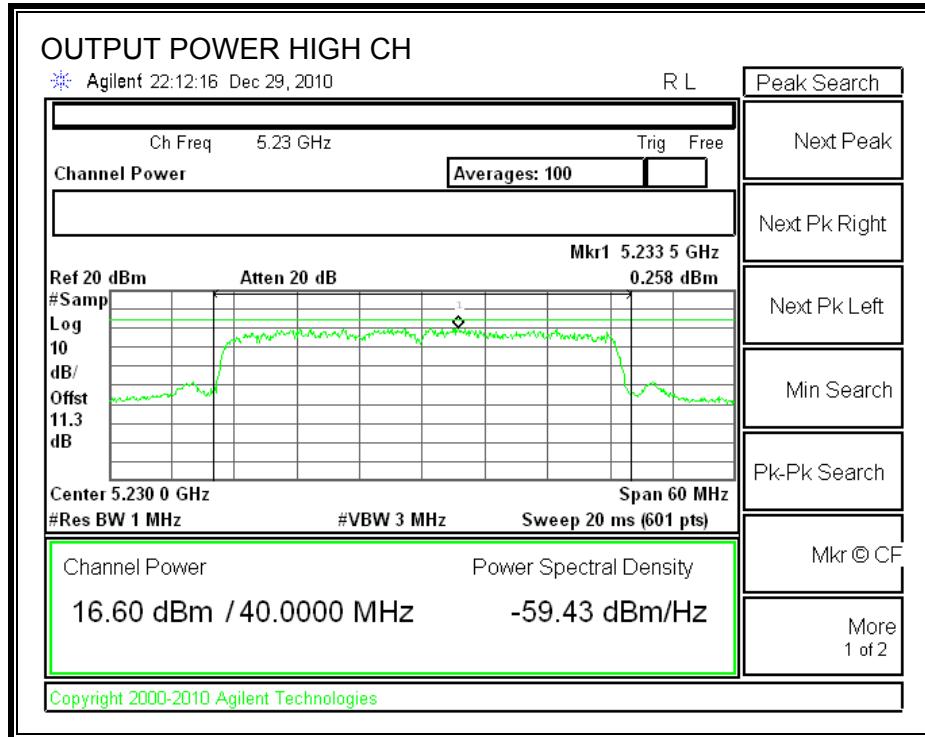
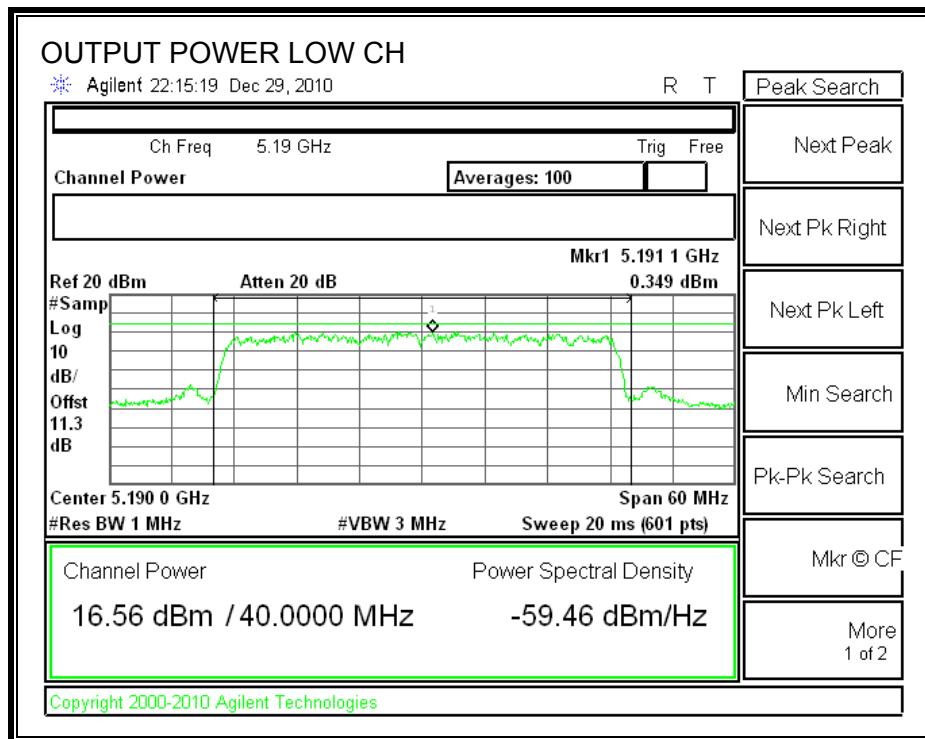
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	38.074	19.81	6.02	16.98
High	5230	17	37.914	19.79	6.02	16.98

Results

Channel	Frequency (MHz)	Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	16.56	16.98	-0.42
High	5230	16.60	16.98	-0.38

OUTPUT POWER



7.3.3. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 6.02 dBi, therefore the limit is 3.98 dBm.

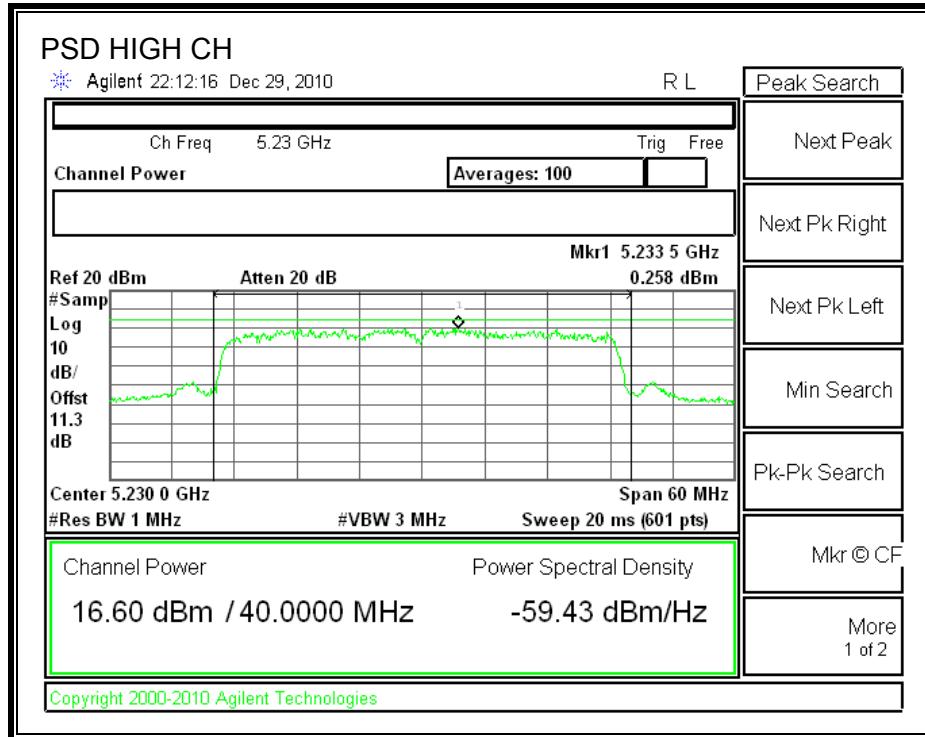
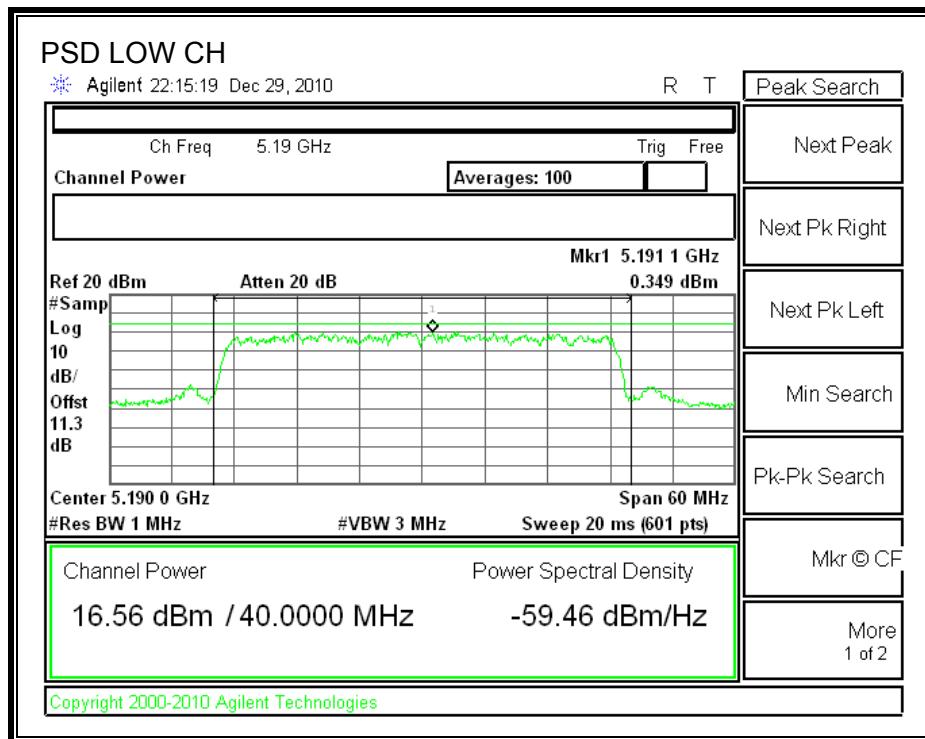
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	0.35	3.98	-3.63
High	5230	0.26	3.98	-3.72

POWER SPECTRAL DENSITY



7.3.4. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

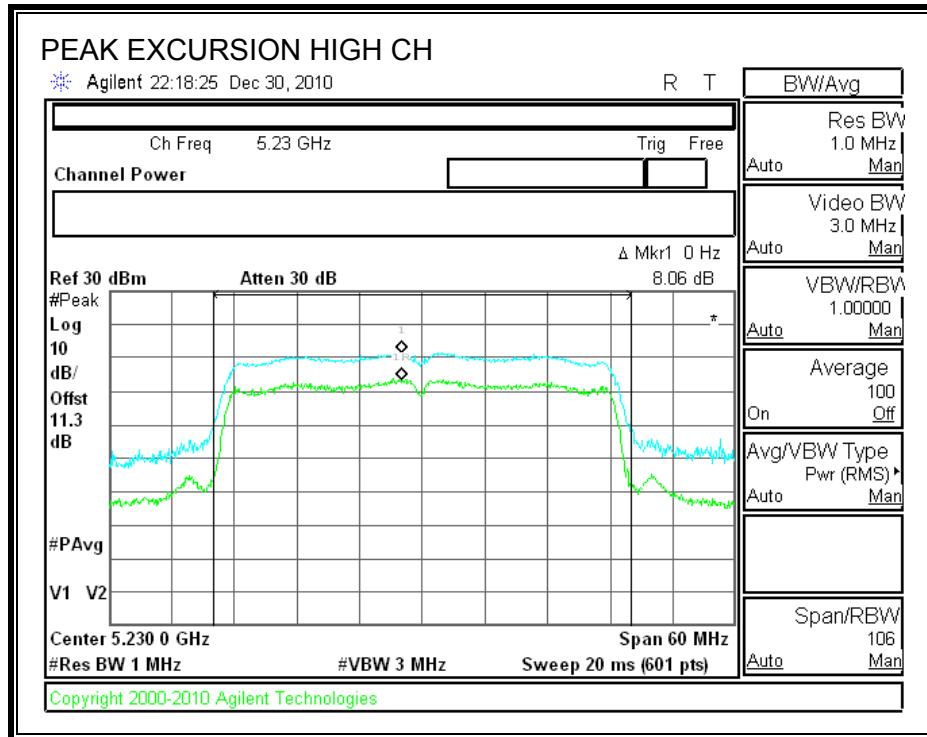
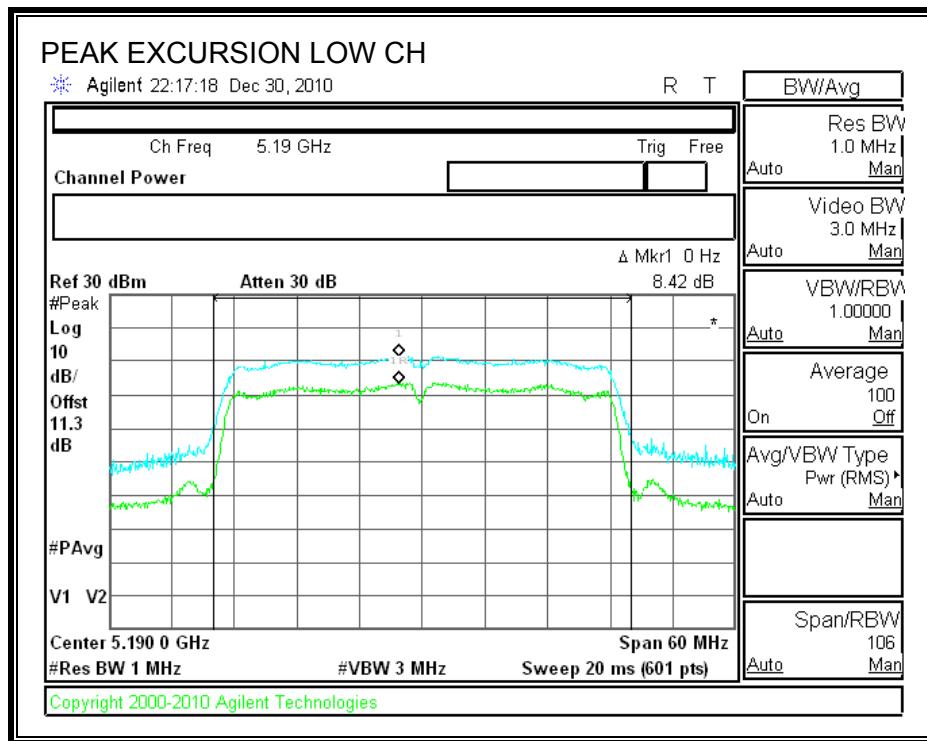
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	8.42	13	-4.58
High	5230	8.06	13	-4.94

PEAK EXCURSION



7.3.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

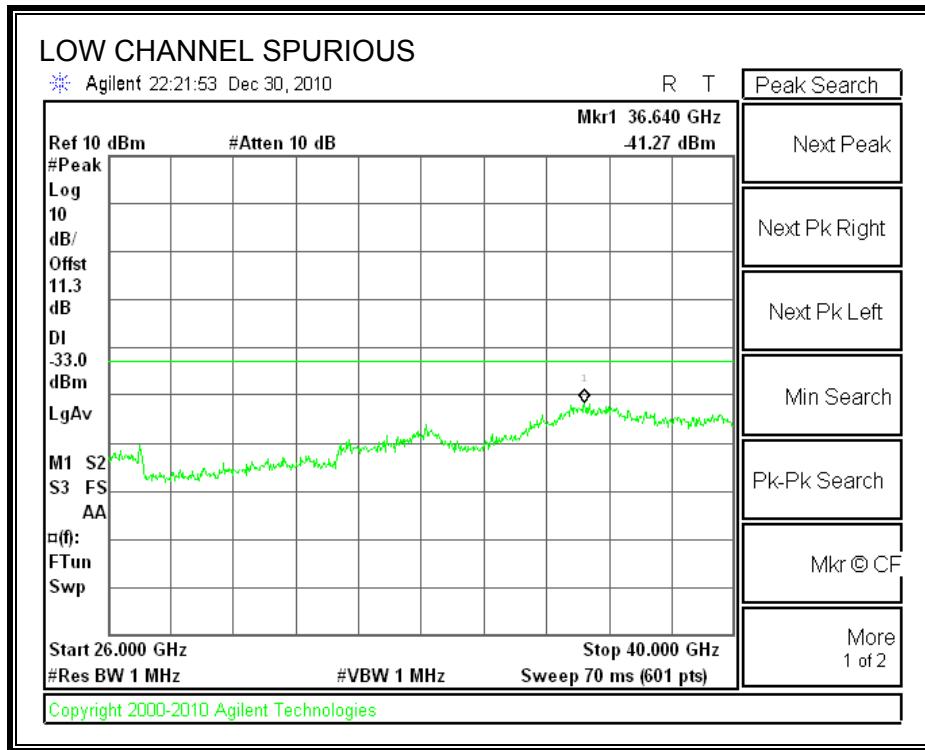
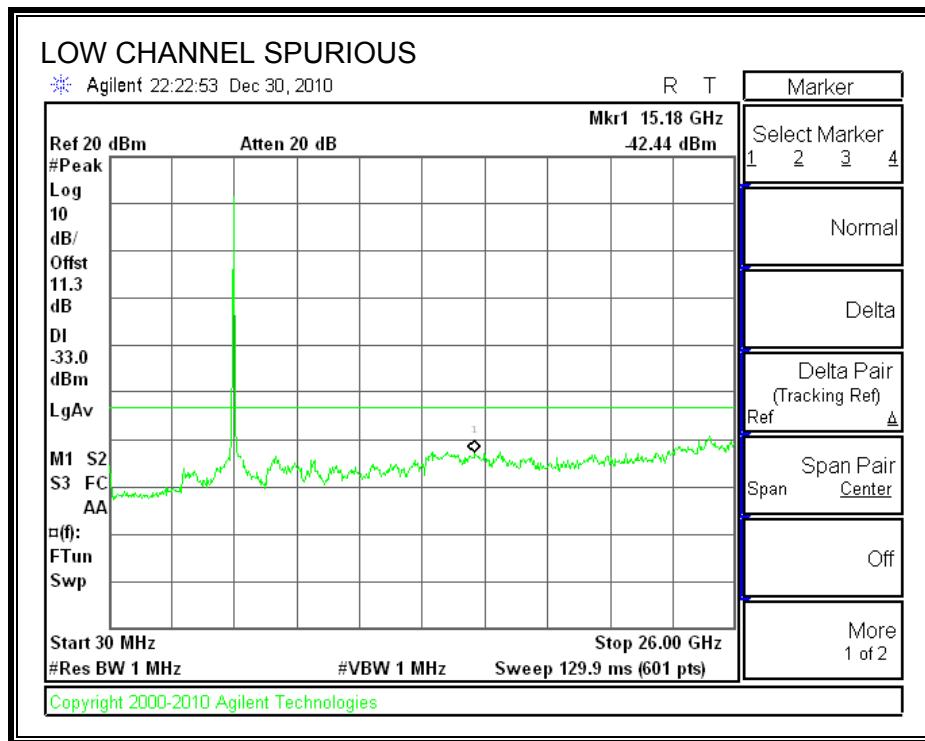
TEST PROCEDURE

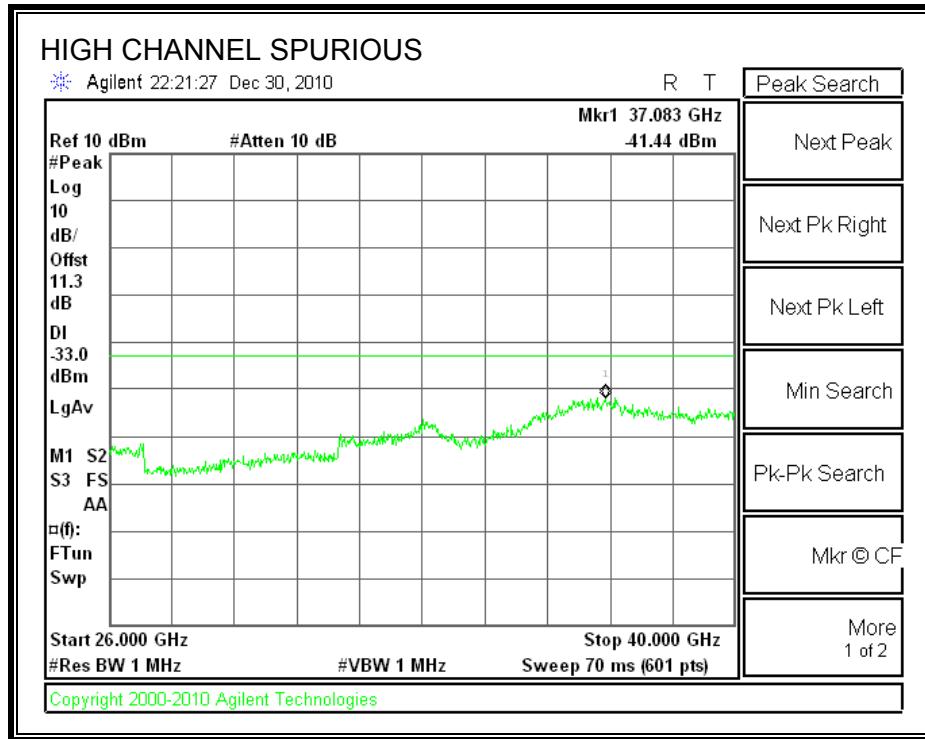
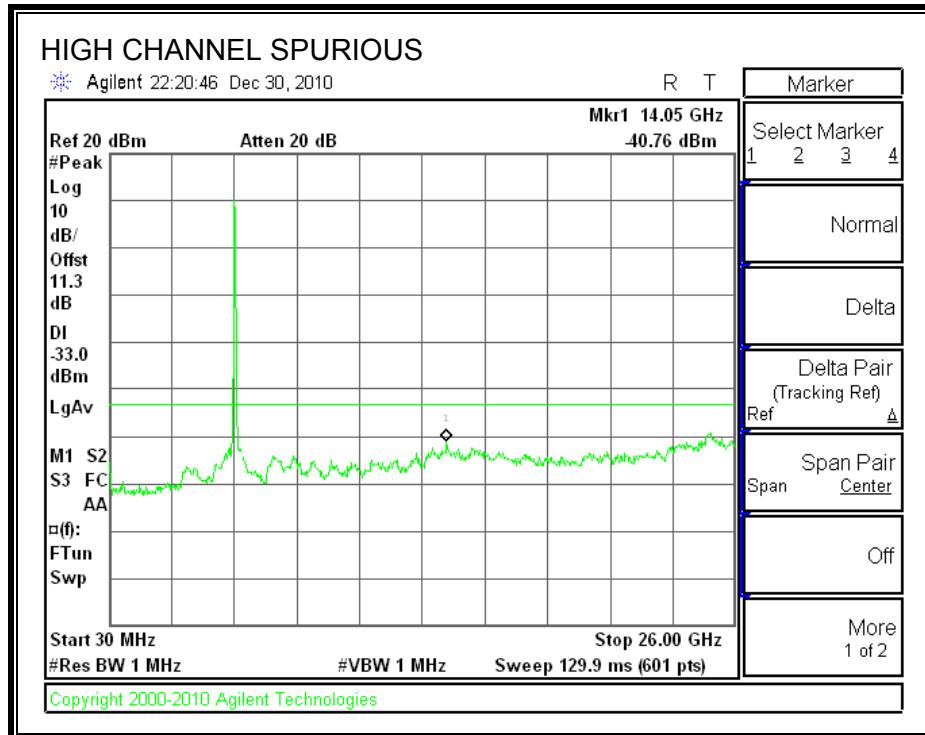
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS





7.4. 802.11n DUAL CHAIN HT40 MODE IN THE 5.2 GHz BAND

STBC MCS0

7.4.1. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

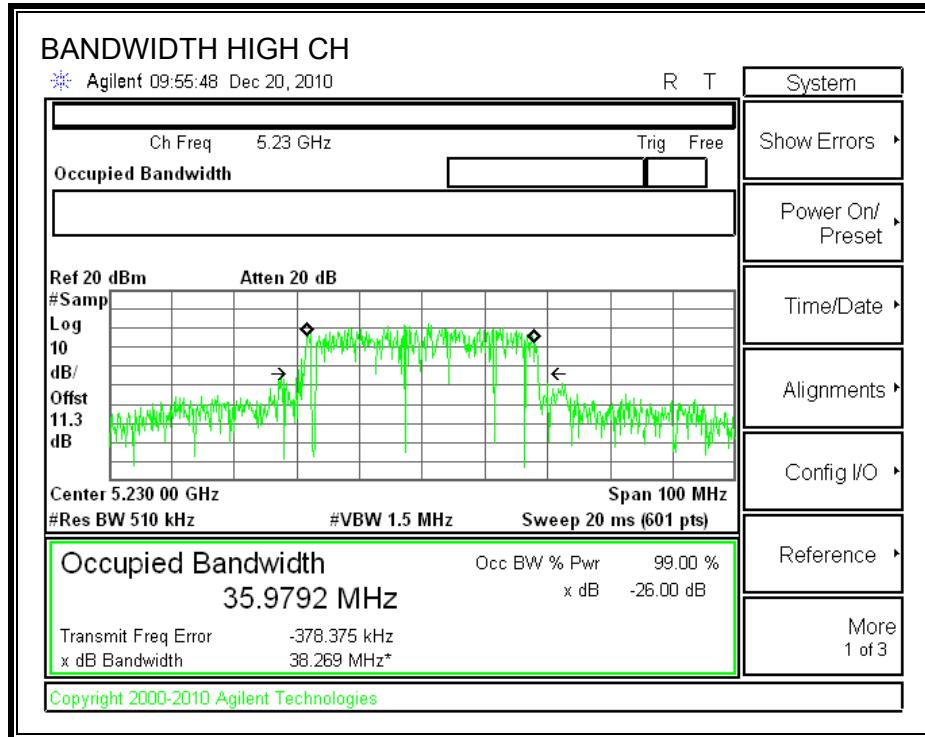
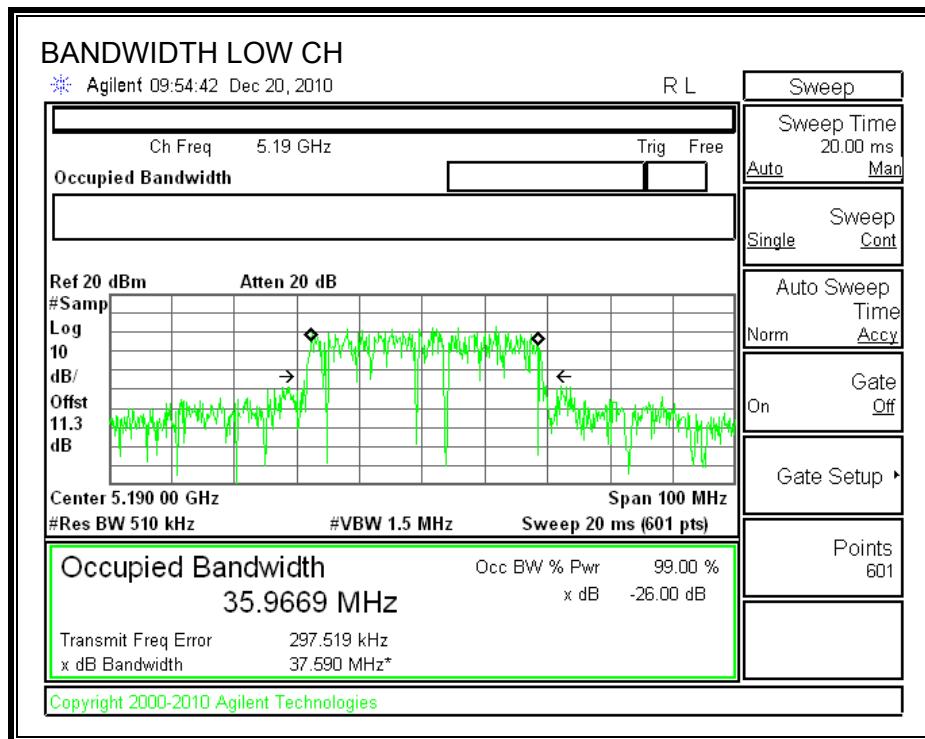
TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	37.590	35.9669
High	5230	38.269	35.9792

26 dB and 99% BANDWIDTH



7.4.2. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

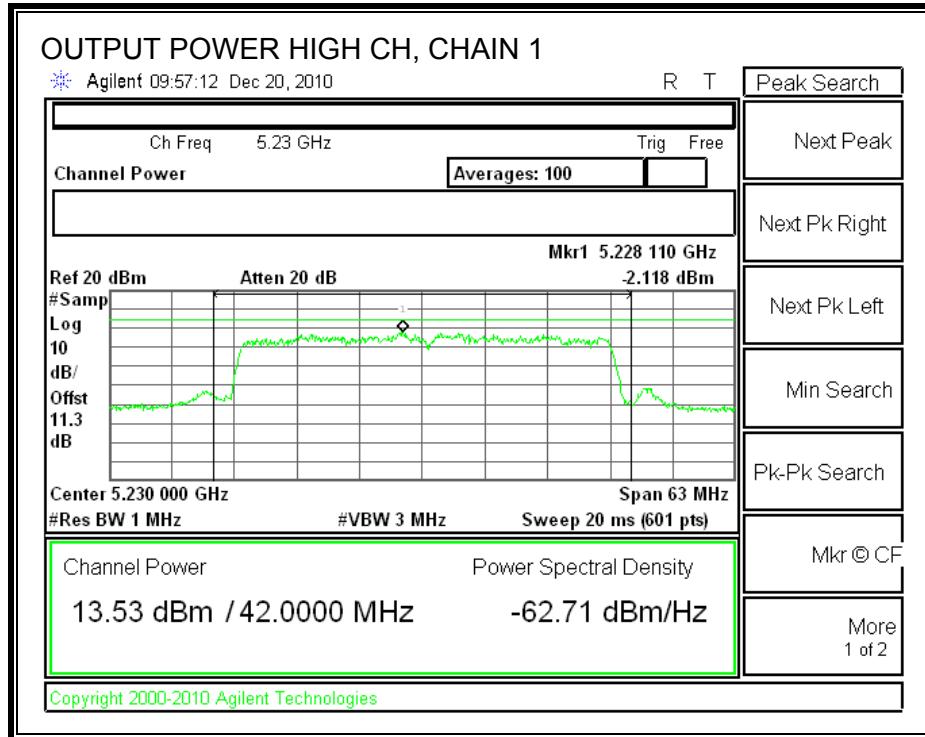
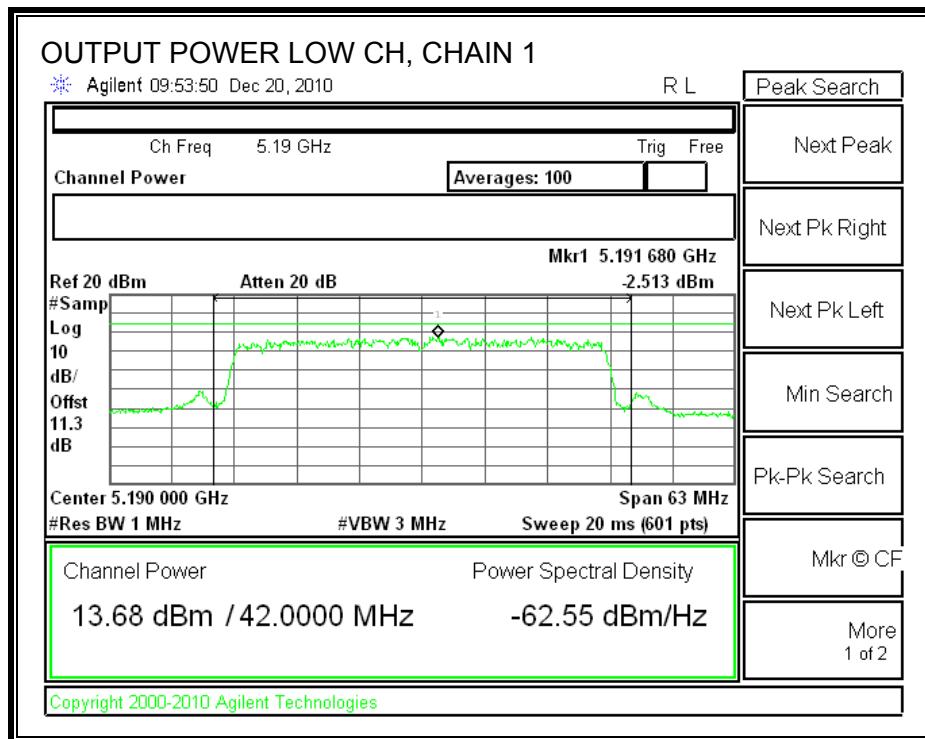
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	37.590	19.75	6.02	16.98
High	5230	17	38.269	19.83	6.02	16.98

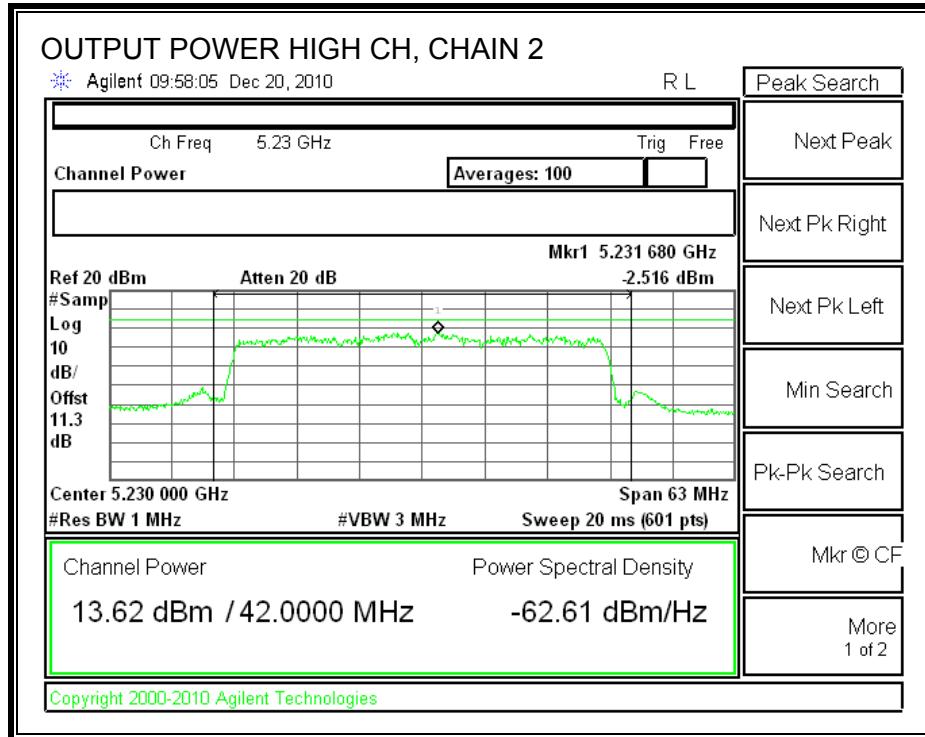
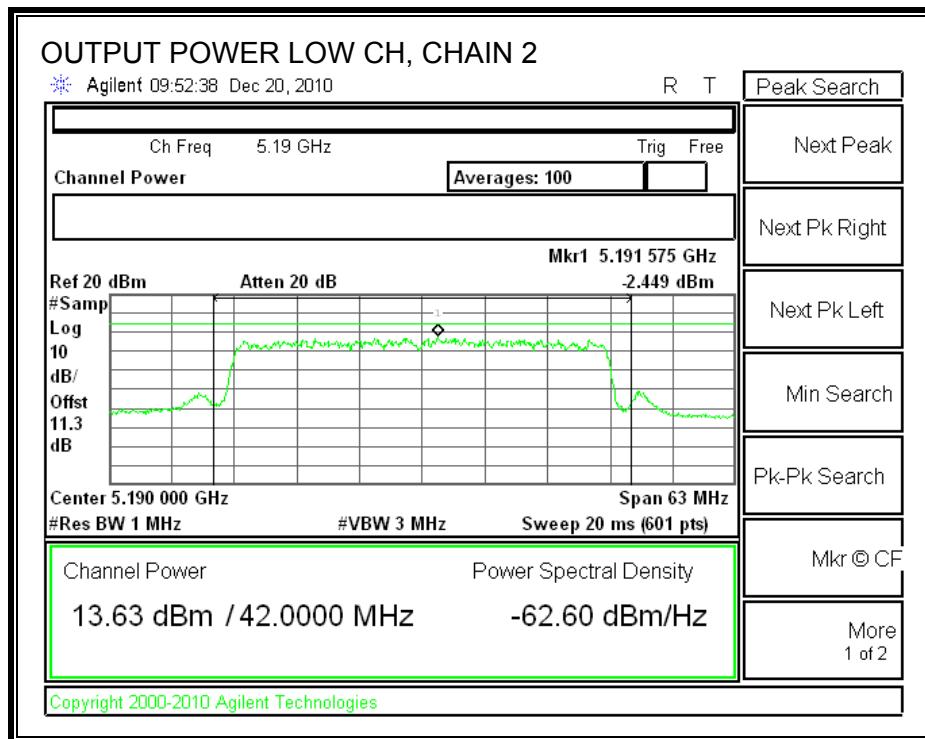
Individual Chain Results

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	13.68	13.63	16.67	16.98	-0.31
High	5230	13.53	13.62	16.59	16.98	-0.39

CHAIN 1 OUTPUT POWER



CHAIN 2 OUTPUT POWER



7.4.3. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 6.02 dBi, therefore the limit is 3.98 dBm.

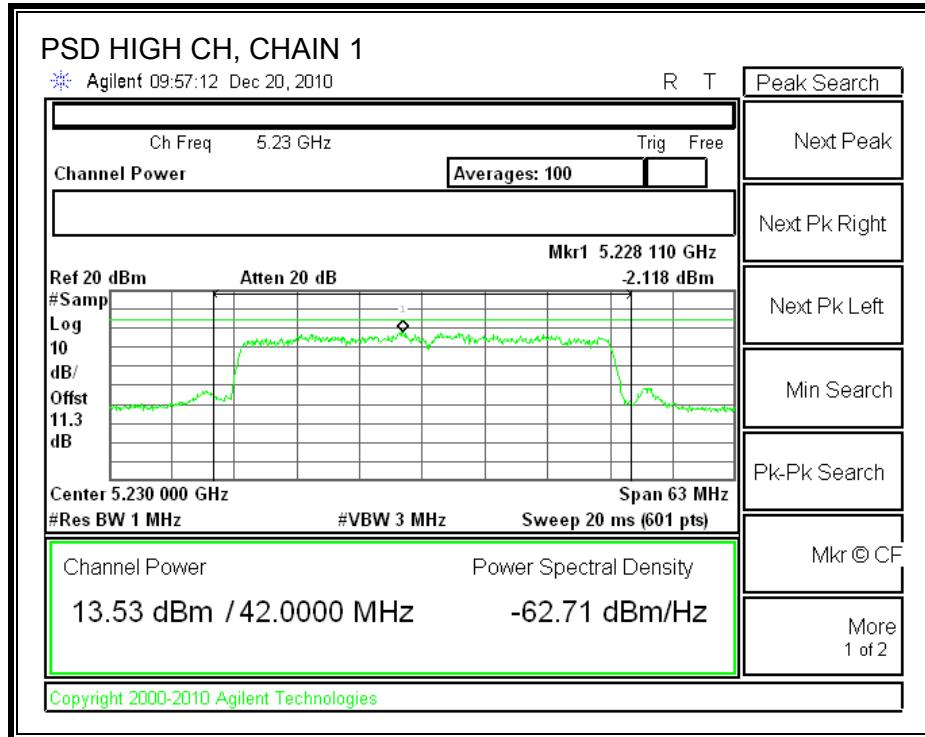
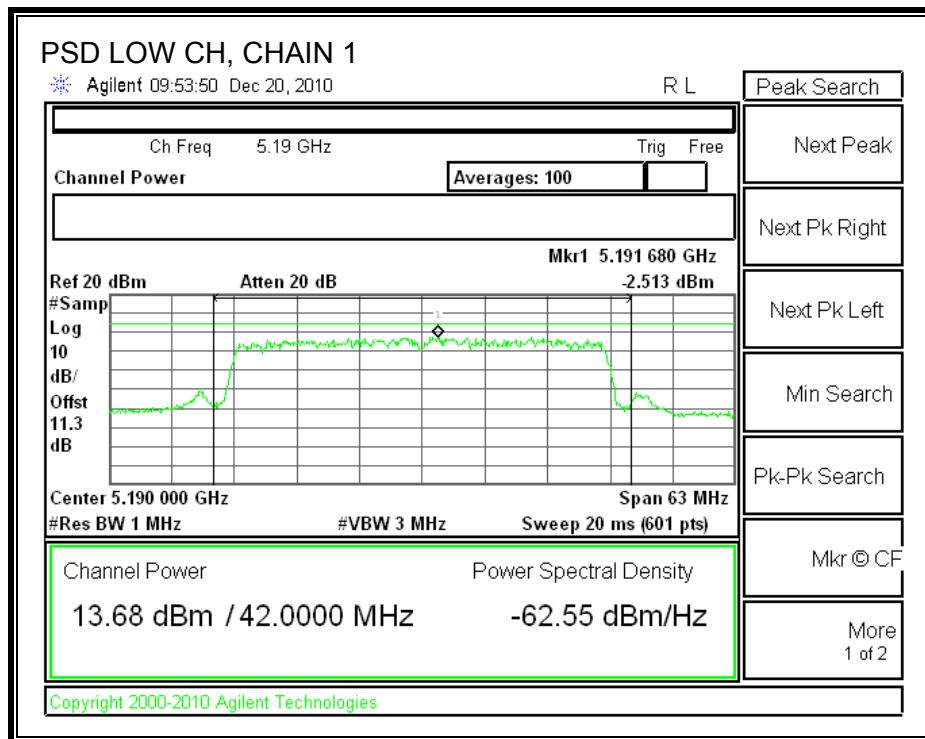
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

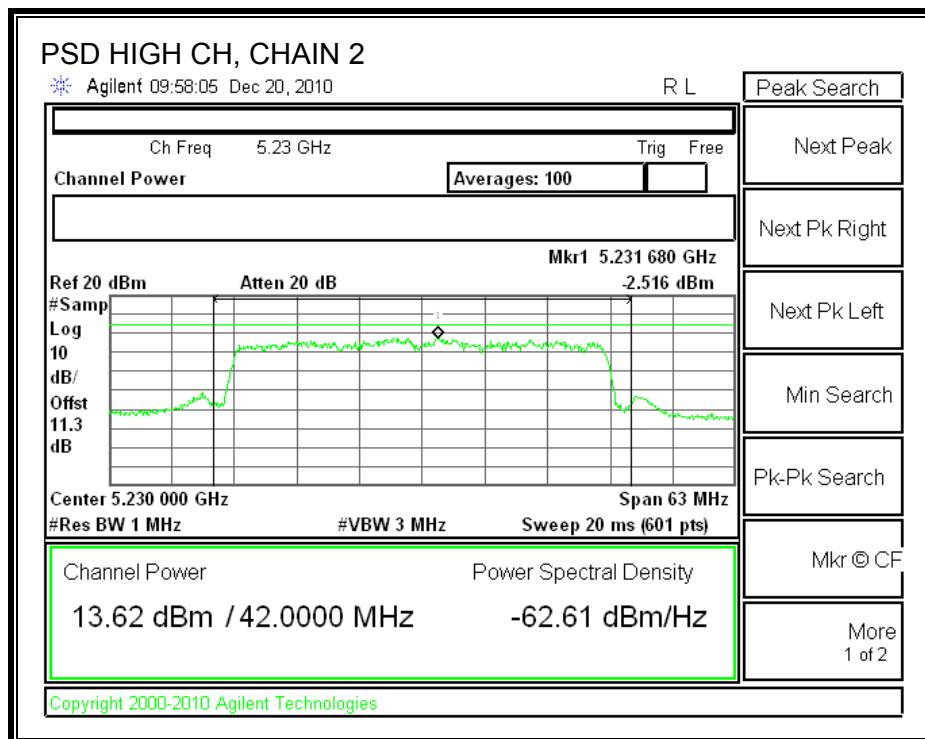
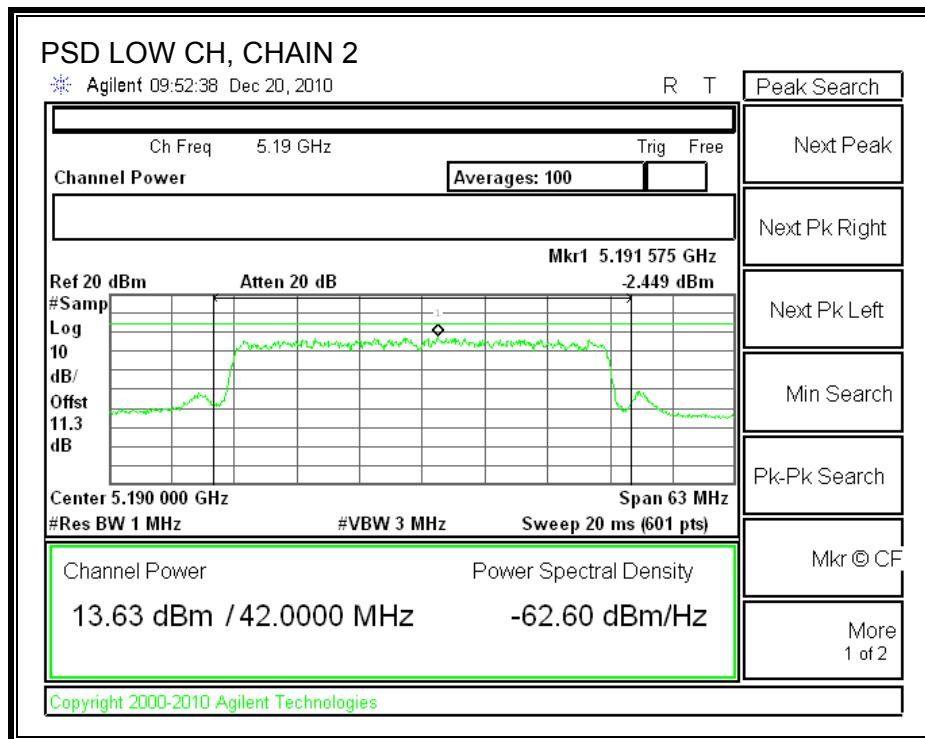
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	-2.513	-2.449	0.53	3.98	-3.45
High	5230	-2.118	-2.516	0.70	3.98	-3.28

CHAIN 1 POWER SPECTRAL DENSITY



CHAIN 2 POWER SPECTRAL DENSITY



7.4.4. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

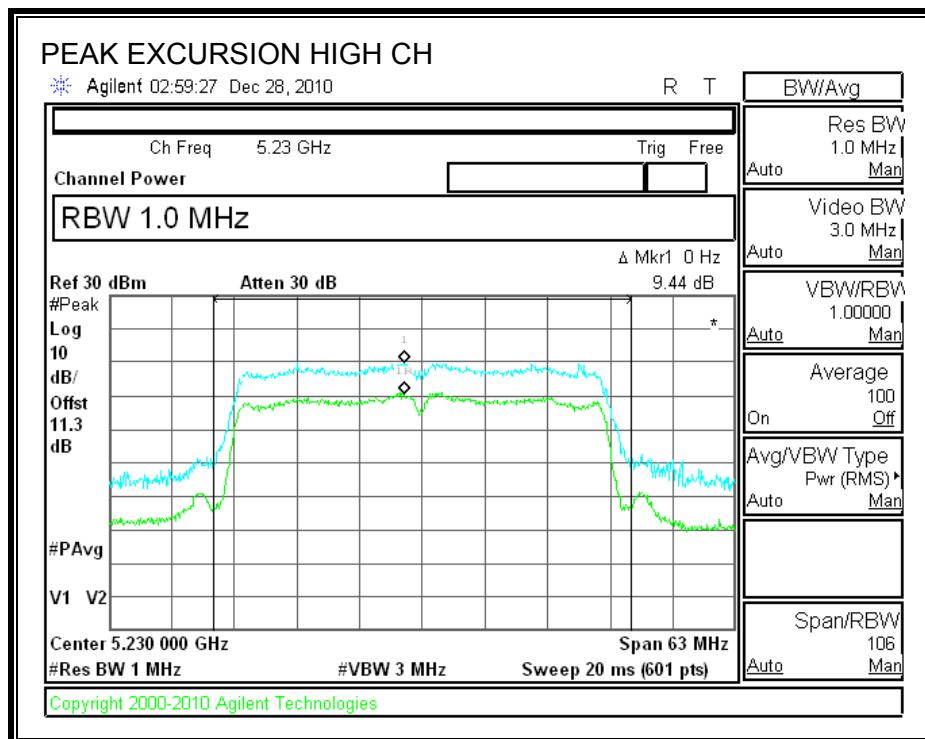
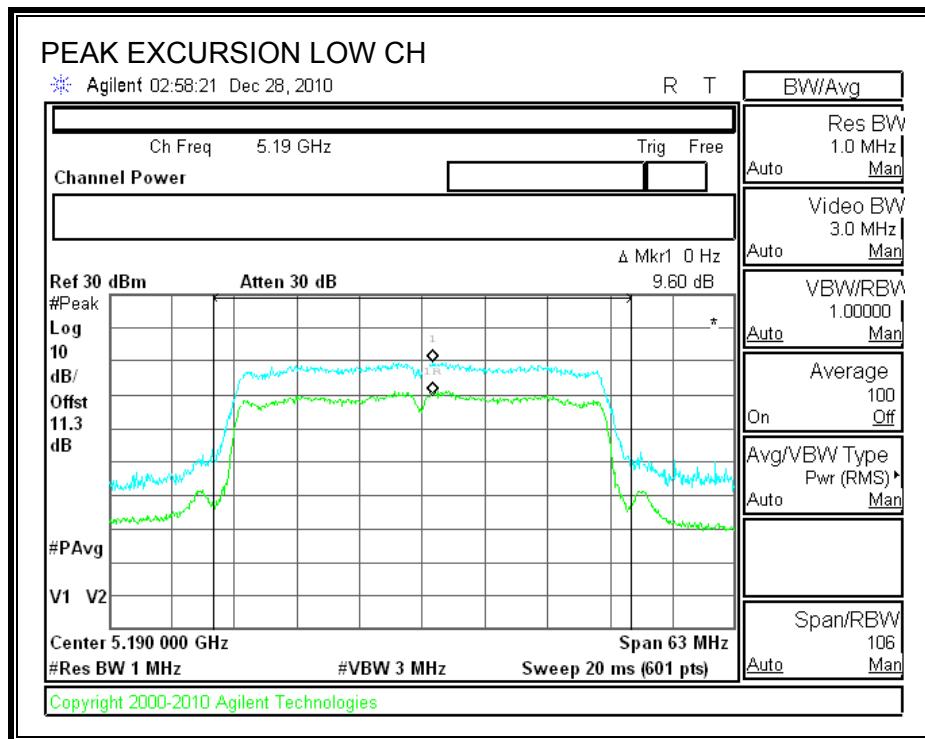
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	9.60	13	-3.40
High	5230	9.44	13	-3.56

PEAK EXCURSION



7.4.5. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

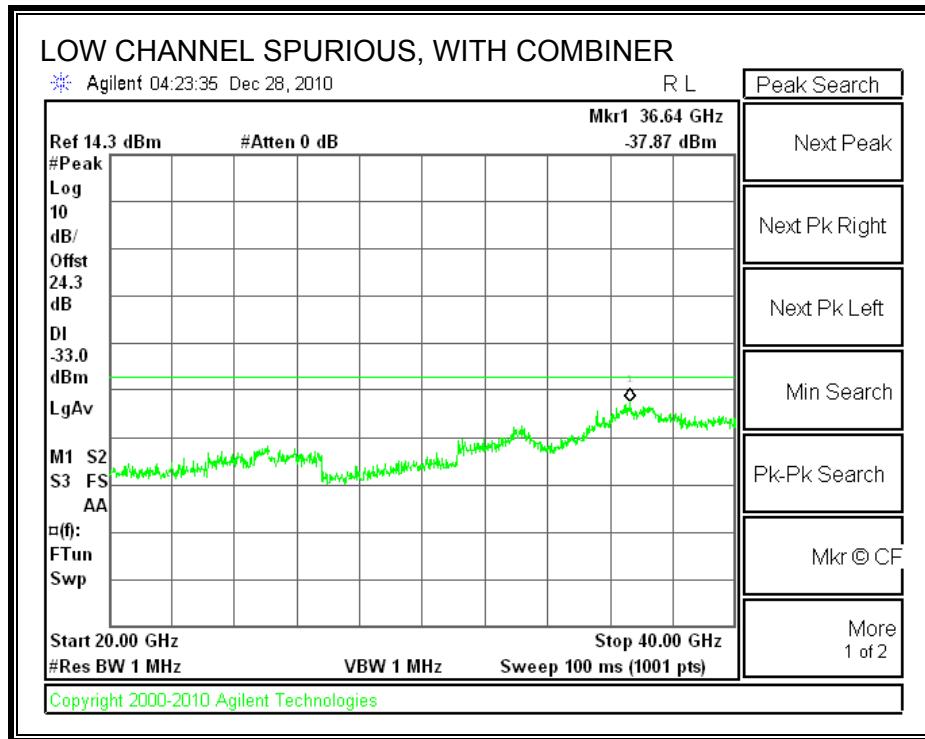
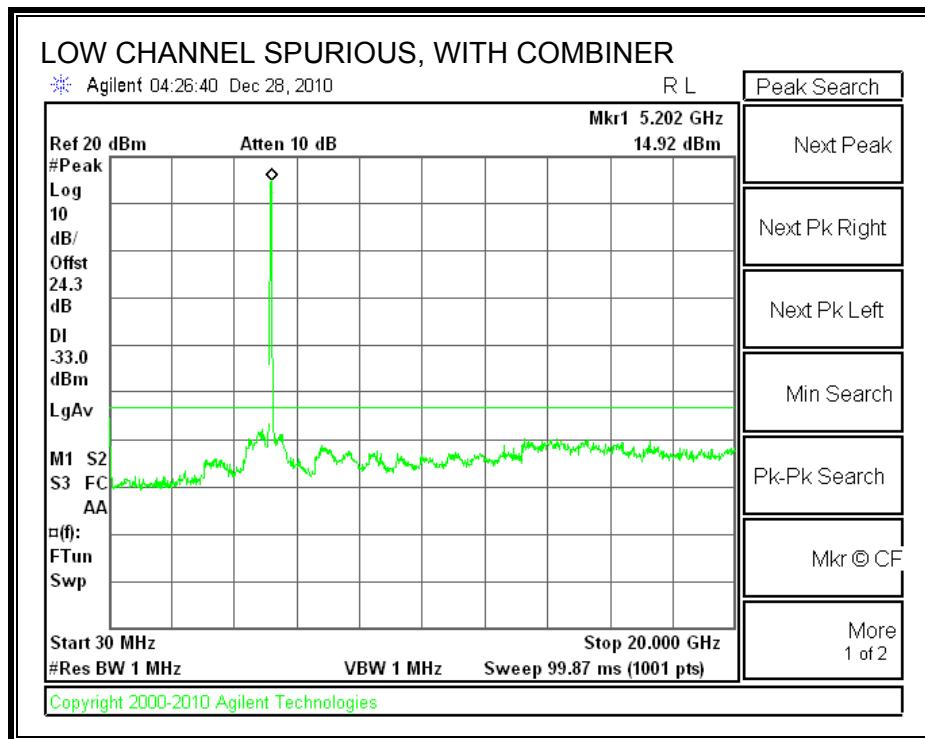
TEST PROCEDURE

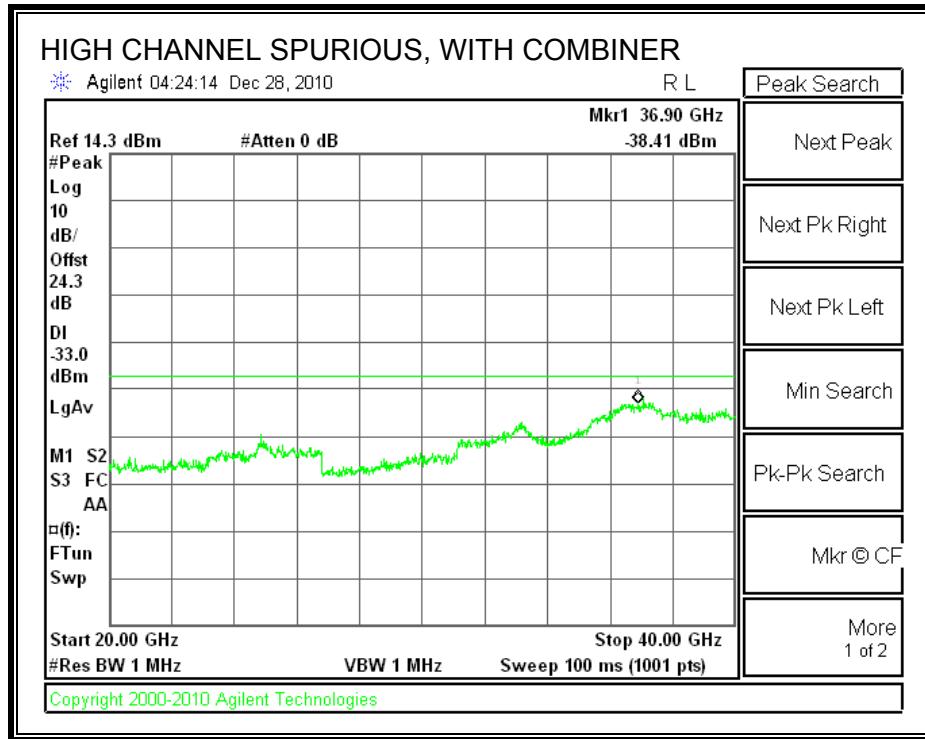
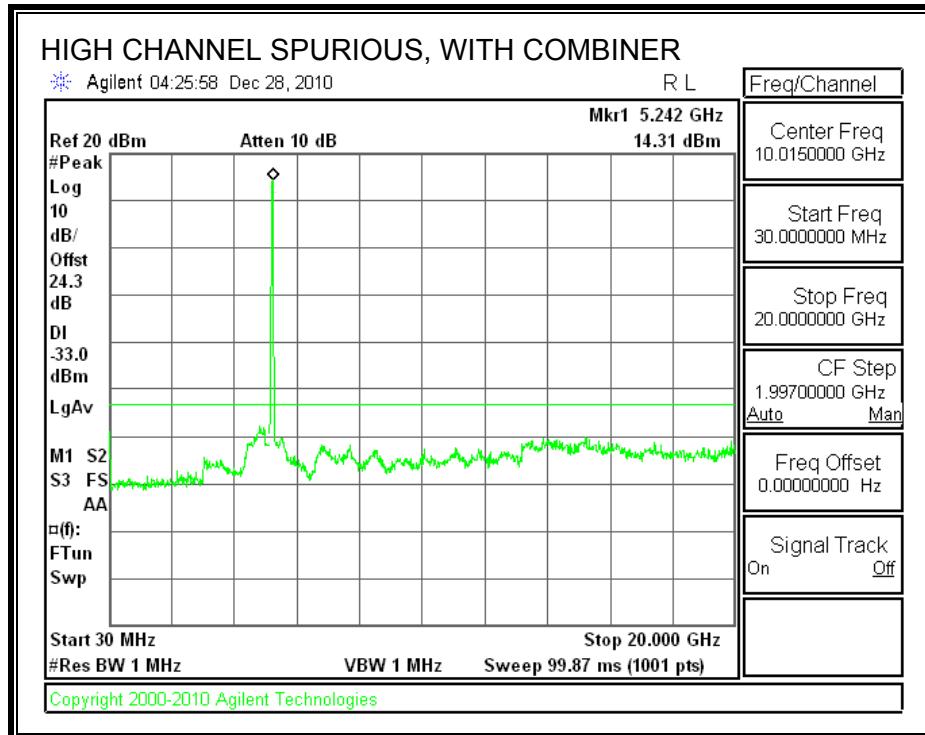
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER





SDM MCS 8

7.4.6. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

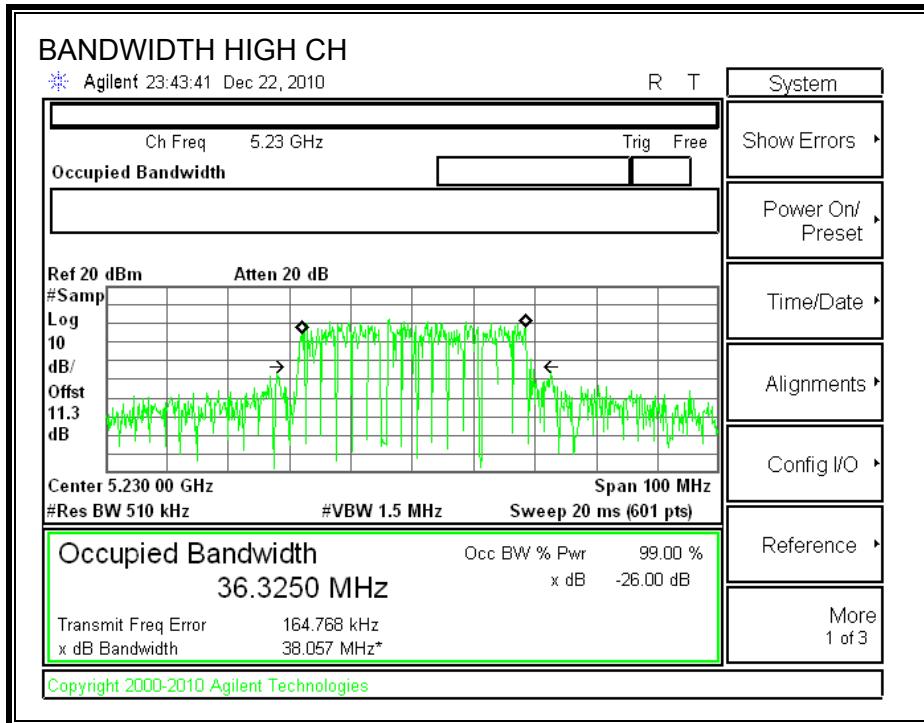
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	37.82	36.23
High	5230	38.057	36.325

26 dB and 99% BANDWIDTH



7.4.7. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

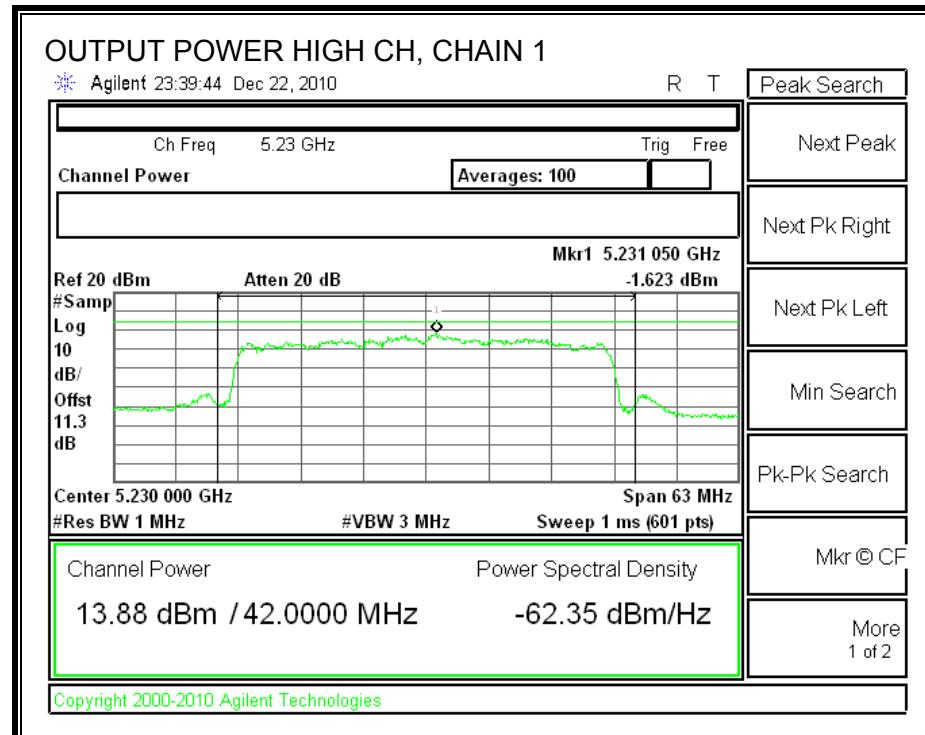
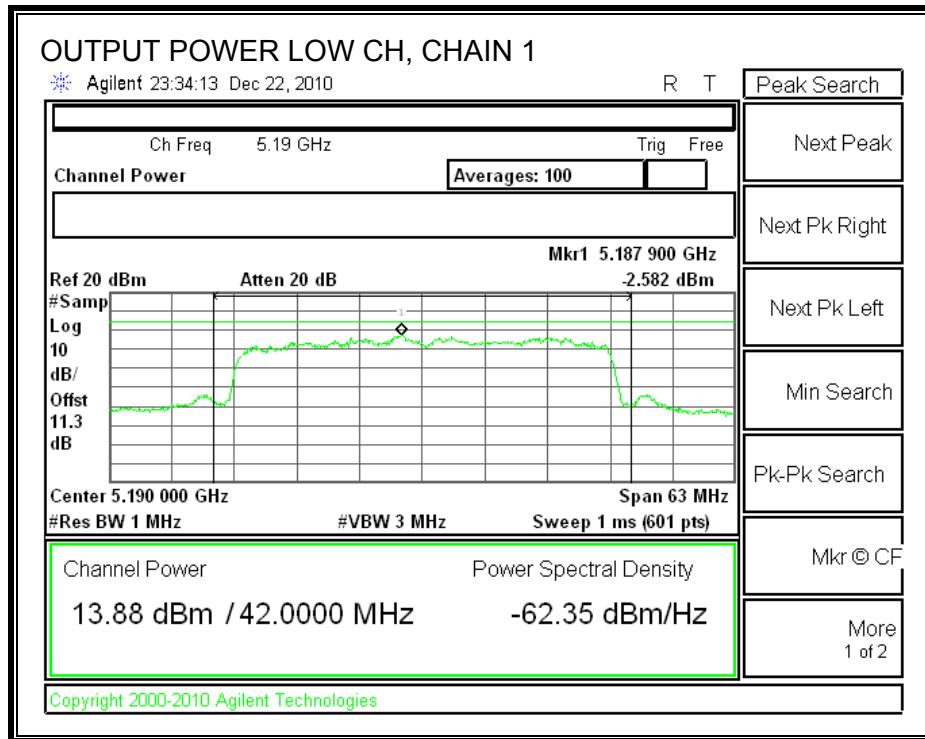
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	37.82	19.78	6.02	16.98
High	5230	17	38.057	19.80	6.02	16.98

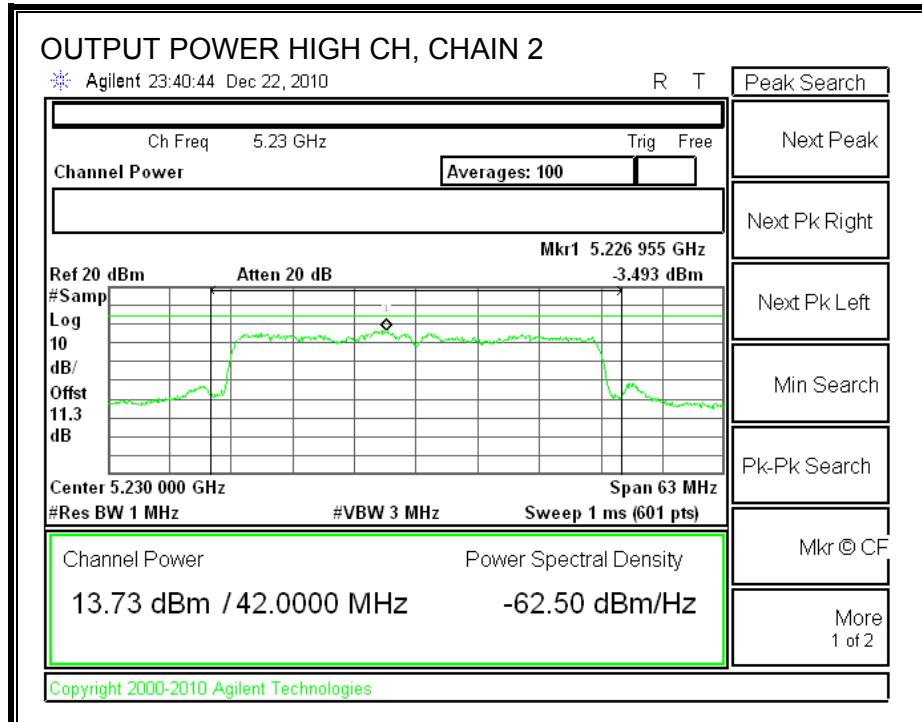
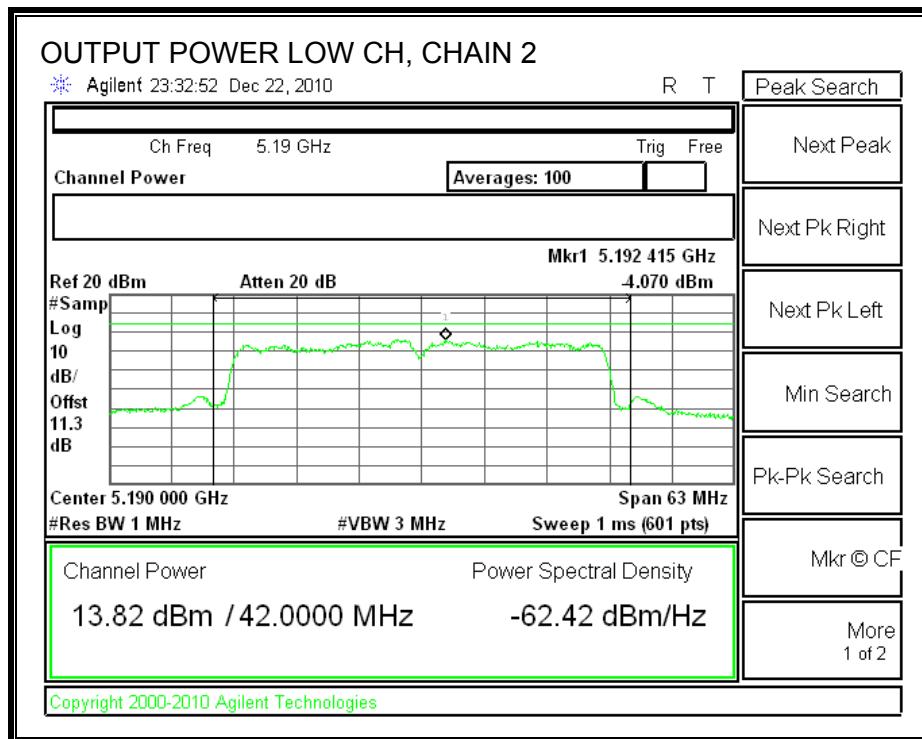
Individual Chain Results

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	13.88	13.82	16.86	16.98	-0.12
High	5230	13.88	13.73	16.82	16.98	-0.16

CHAIN 1 OUTPUT POWER



CHAIN 2 OUTPUT POWER



7.4.8. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 6.02 dBi, therefore the limit is 3.98 dBm.

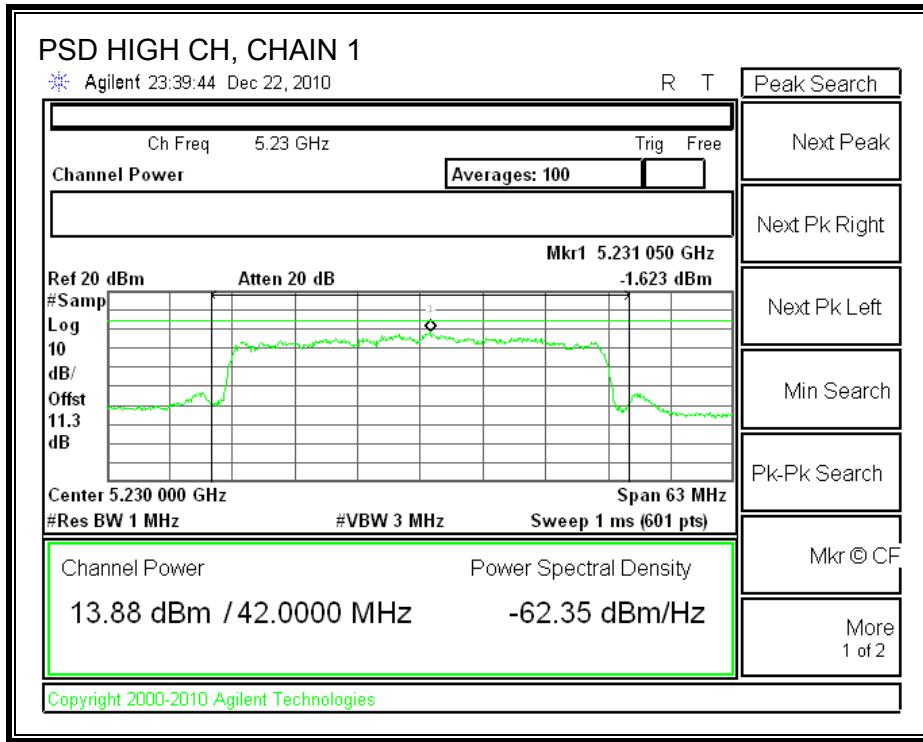
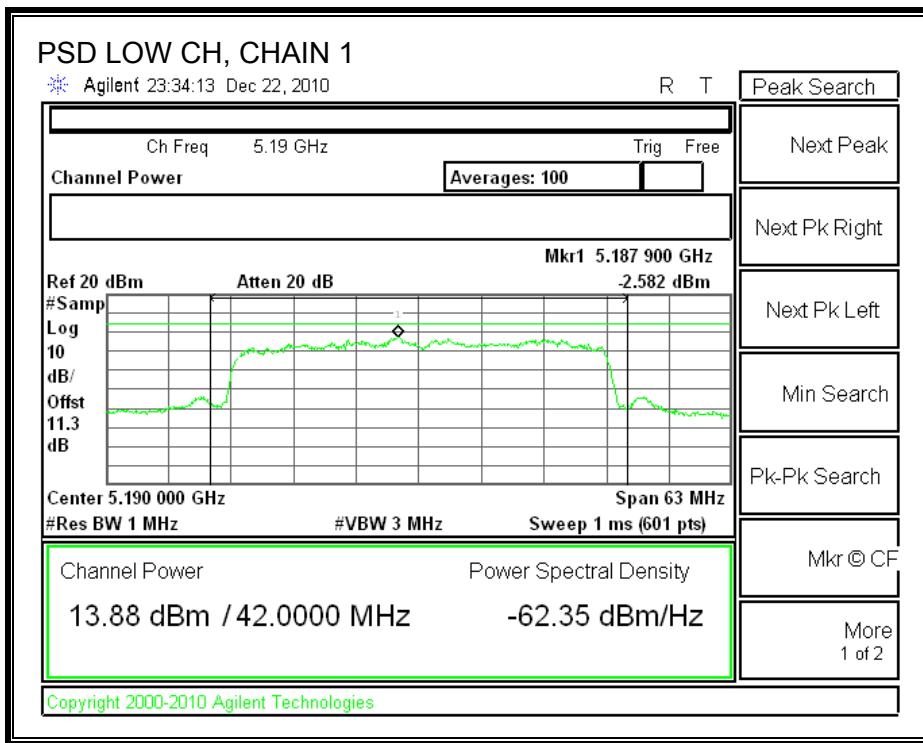
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

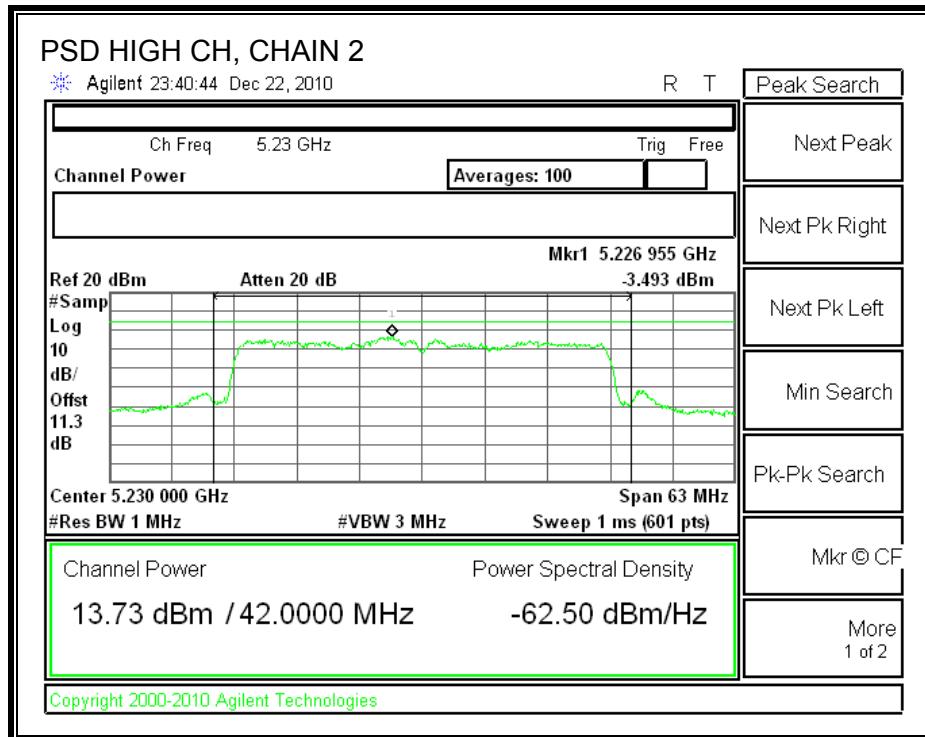
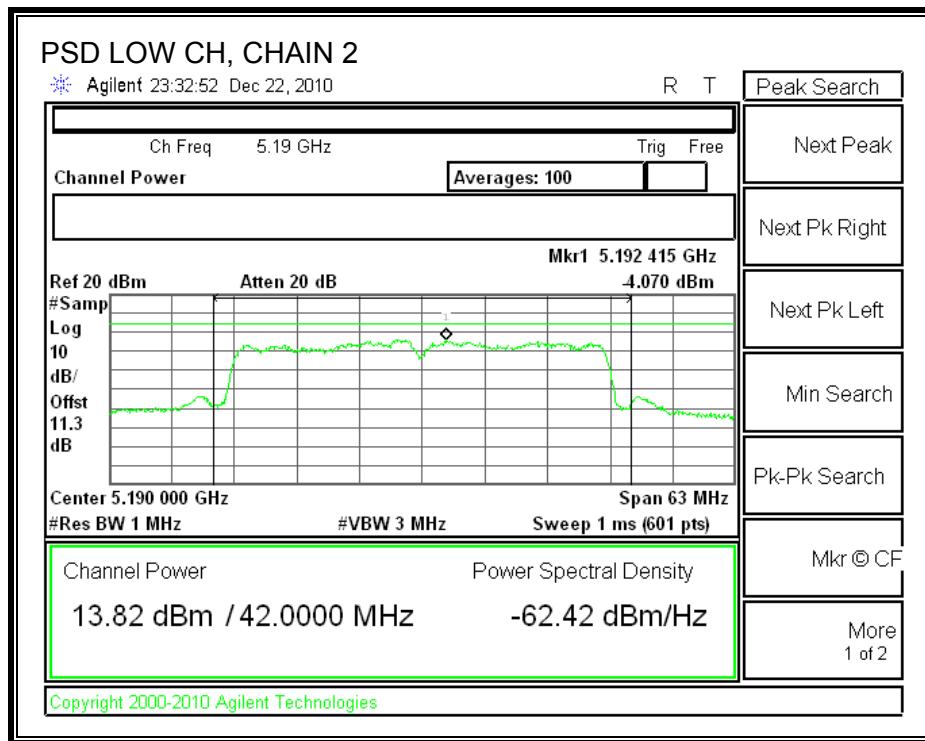
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	-2.582	-4.07	-0.25	3.98	-4.23
High	5230	-1.623	-3.493	0.55	3.98	-3.43

CHAIN 1 POWER SPECTRAL DENSITY



CHAIN 2 POWER SPECTRAL DENSITY



7.4.9. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

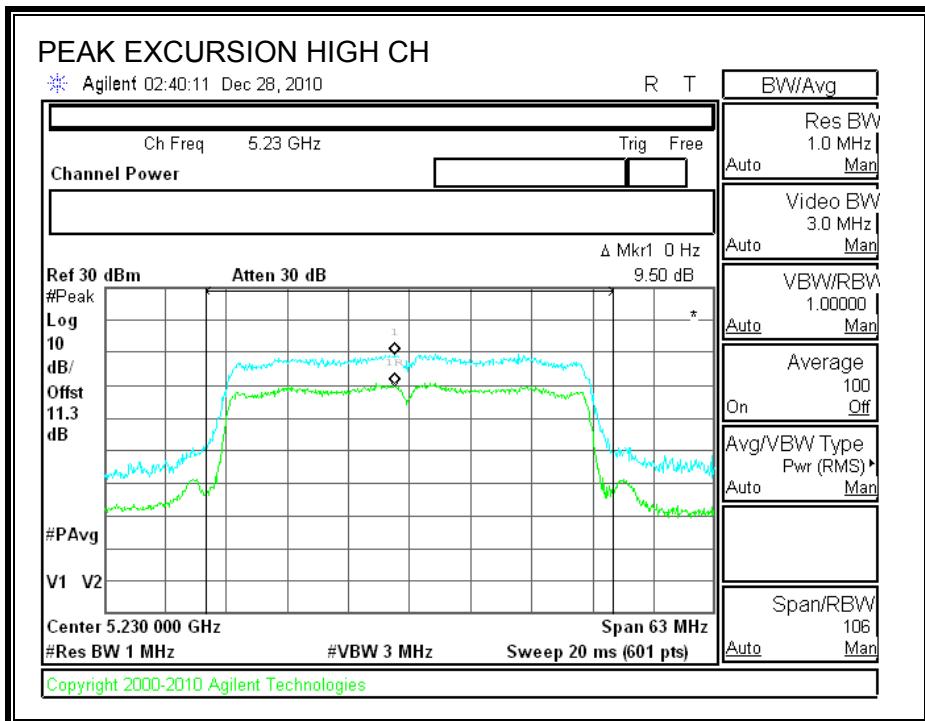
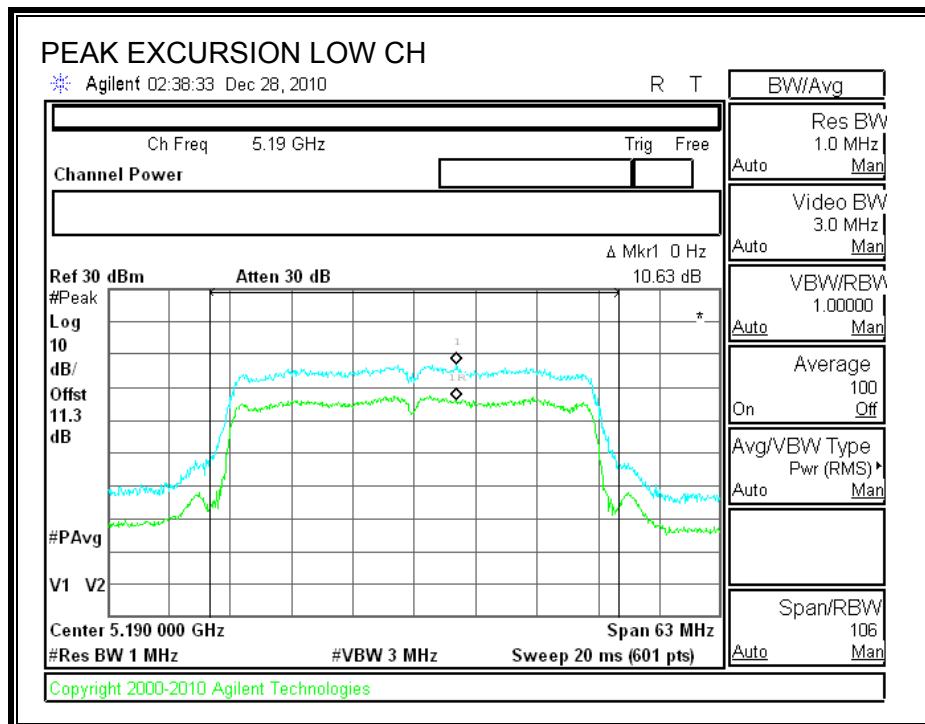
RESULTS

CHAIN 1

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	10.63	13	-2.37
High	5230	9.50	13	-3.50

CHAIN 1

PEAK EXCURSION



7.4.10. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

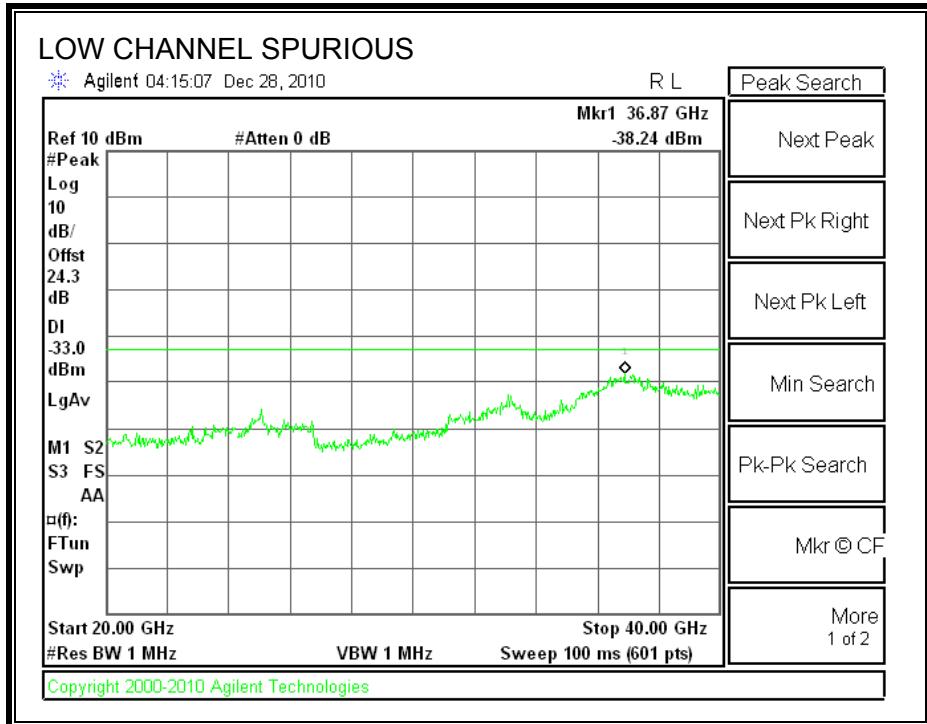
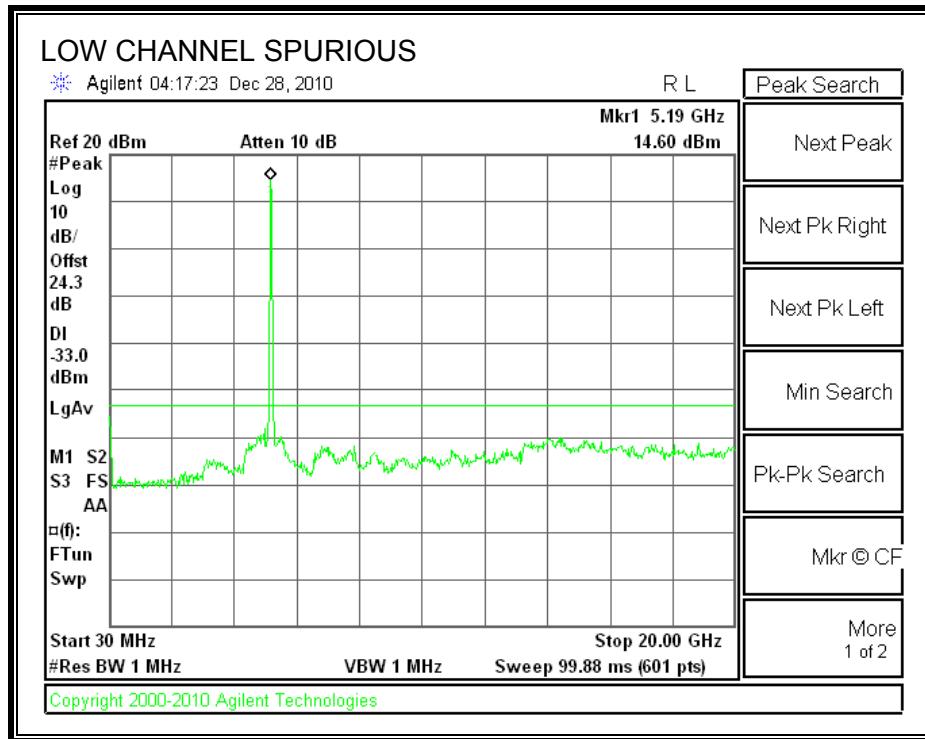
TEST PROCEDURE

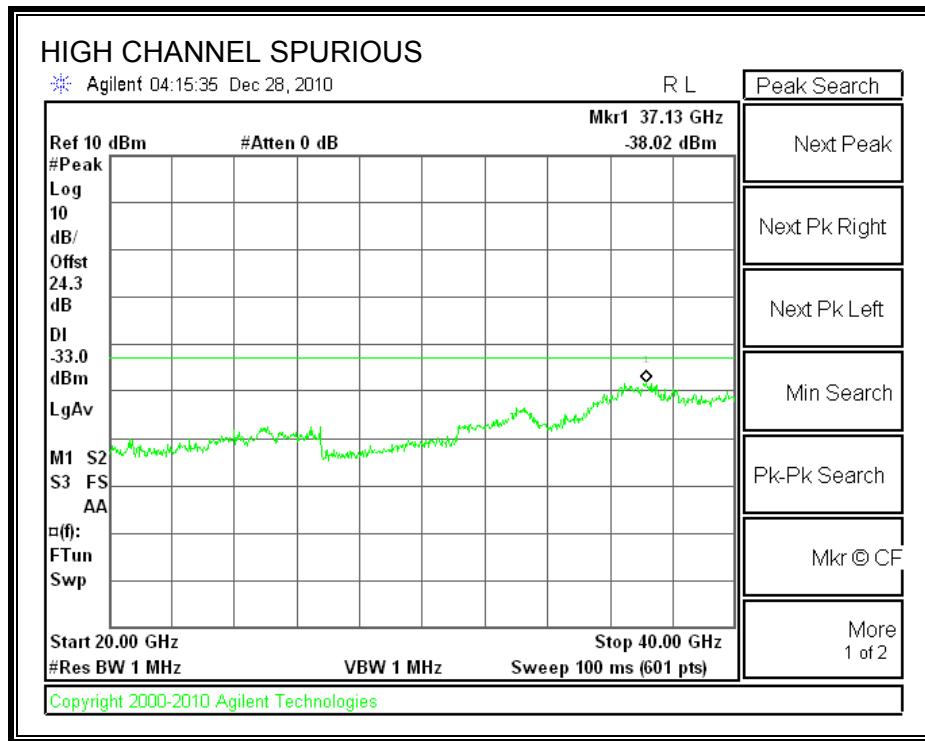
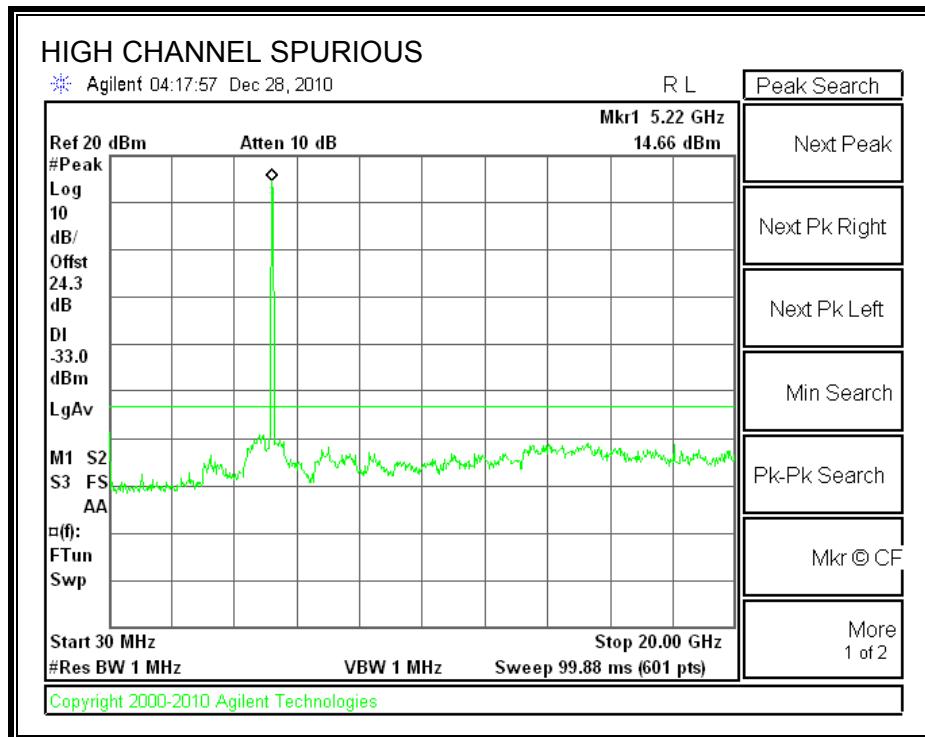
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

RESULTS SPURIOUS EMISSIONS





SDM MCS12

7.4.11. 26 dB and 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

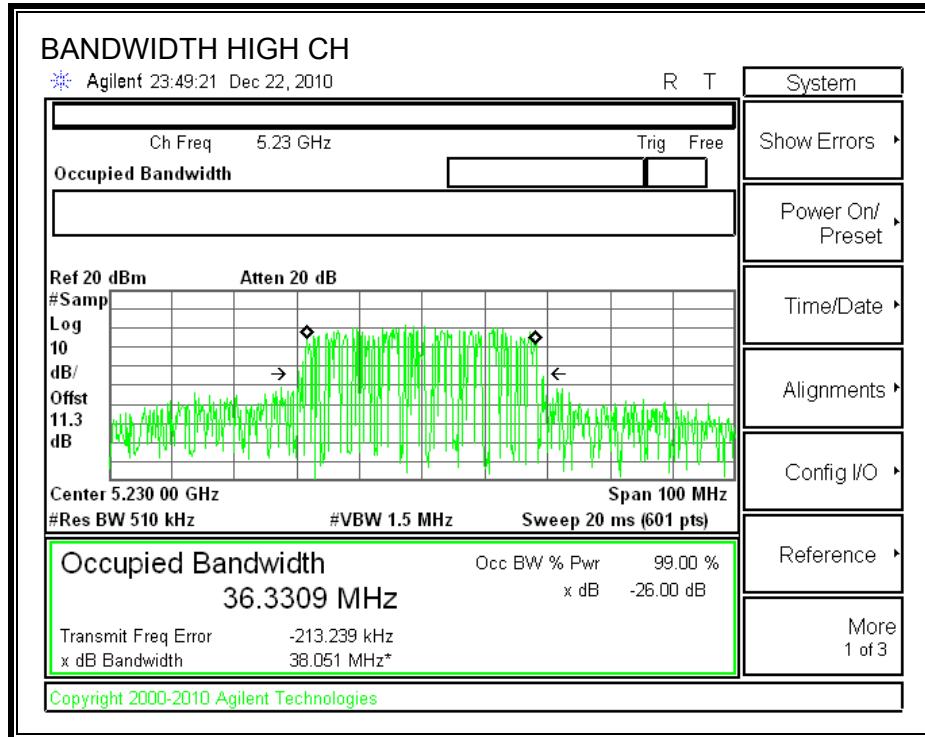
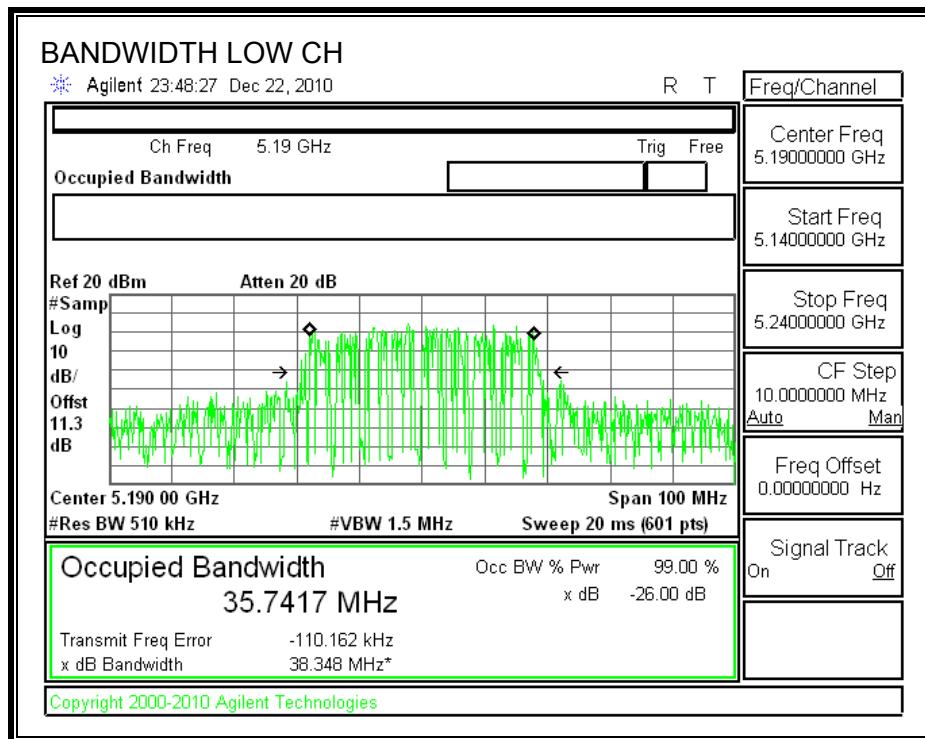
TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	38.348	35.7417
High	5230	38.051	36.3309

26 dB and 99% BANDWIDTH



7.4.12. OUTPUT POWER

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

RESULTS

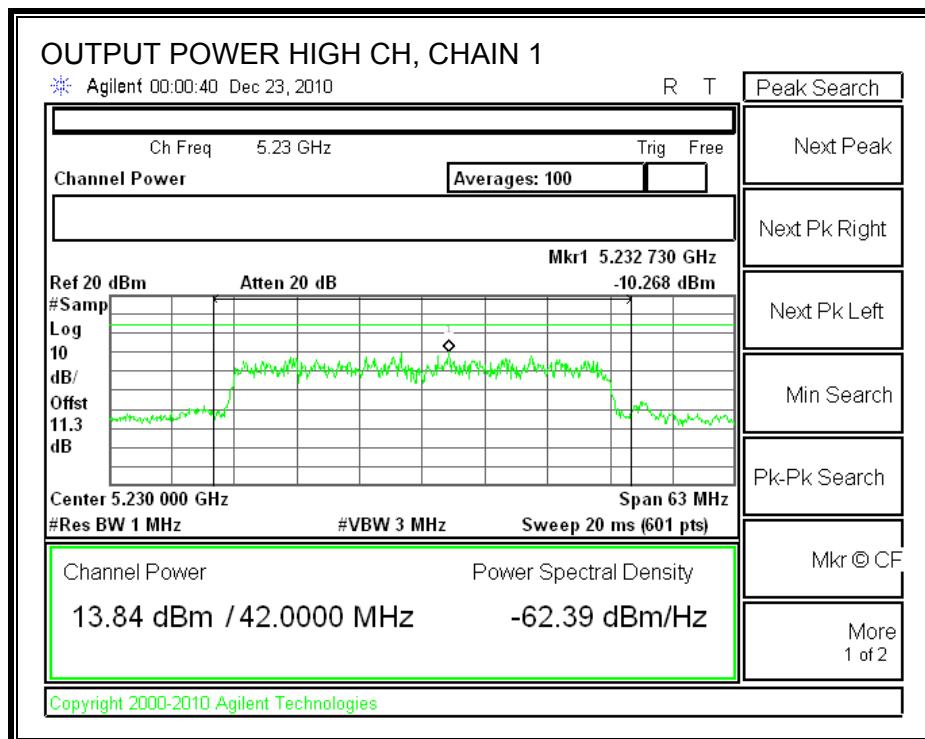
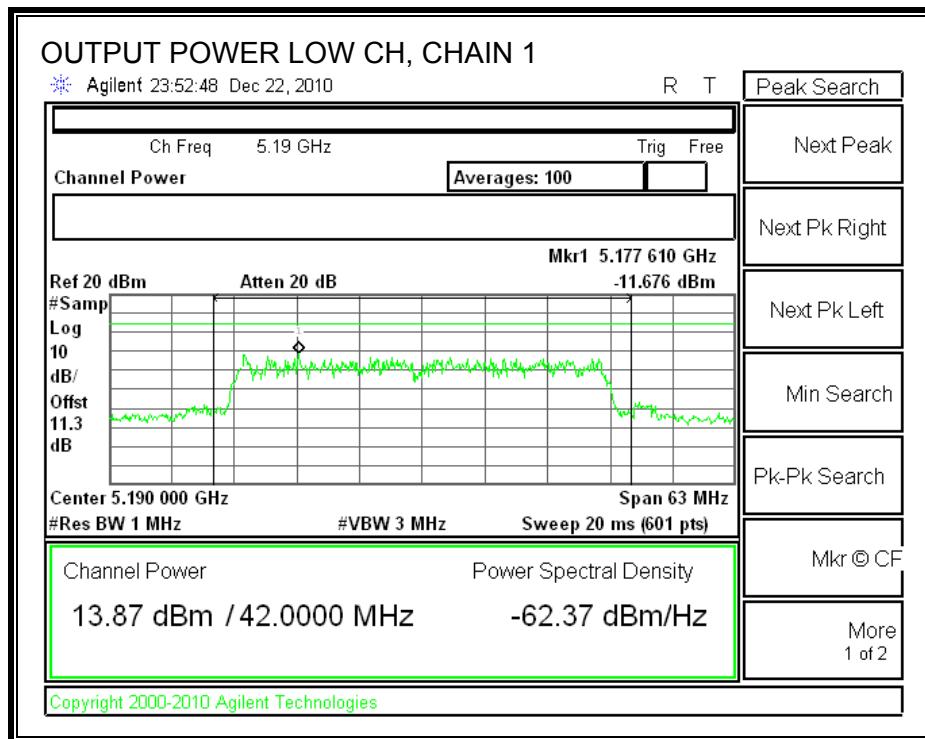
Limit

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	17	38.348	19.84	6.02	16.98
High	5230	17	38.051	19.80	6.02	16.98

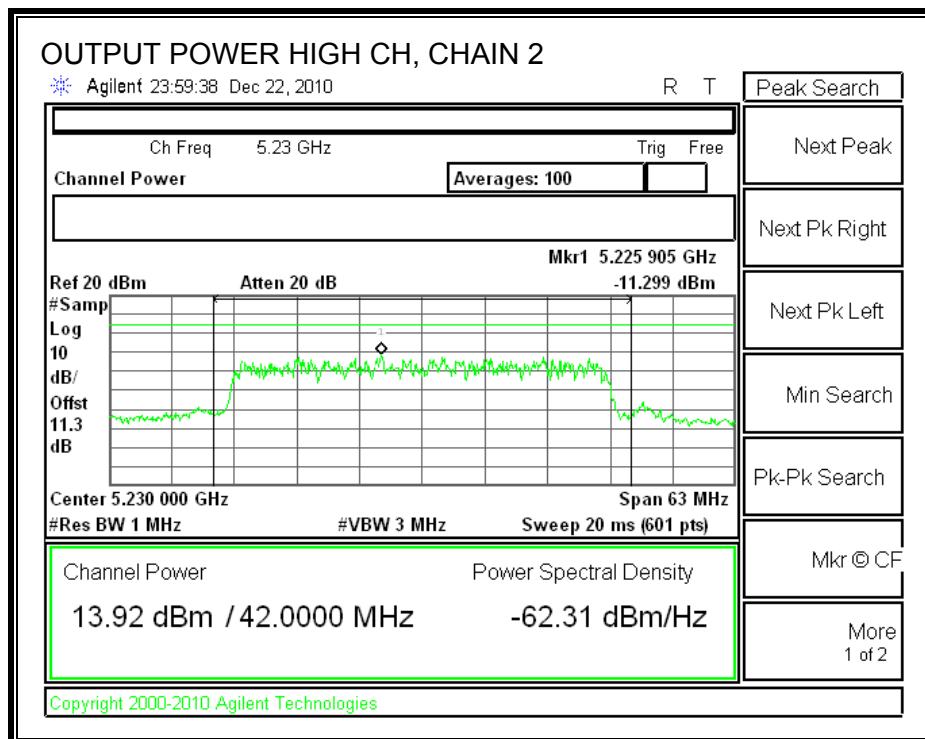
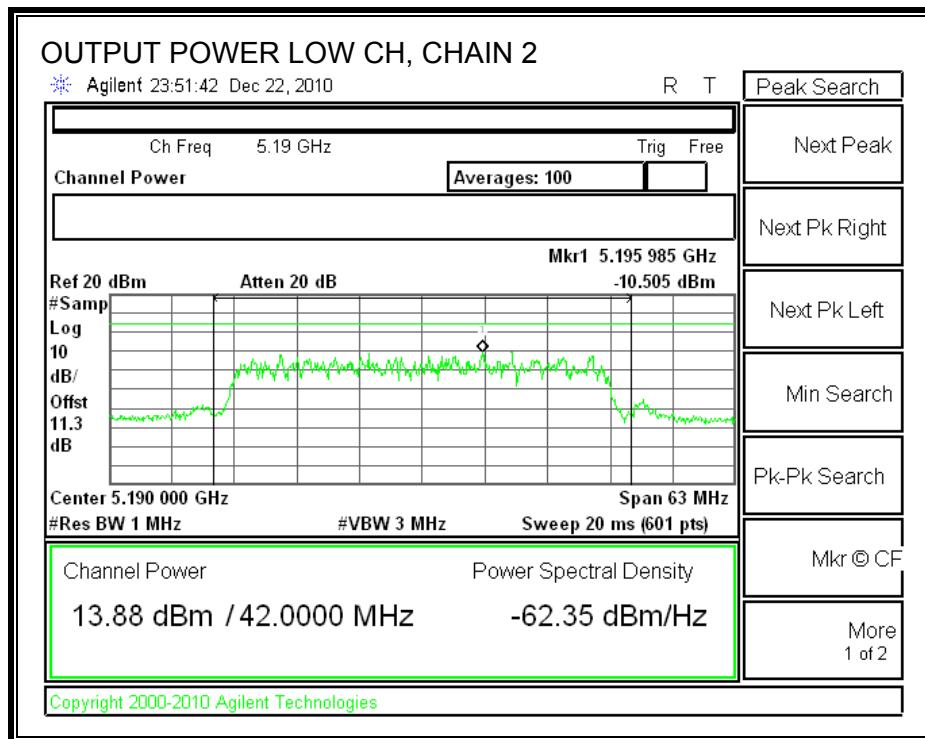
Individual Chain Results

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	13.87	13.88	16.89	16.98	-0.09
High	5230	13.84	13.92	16.89	16.98	-0.09

CHAIN 1 OUTPUT POWER



CHAIN 2 OUTPUT POWER



7.4.13. PEAK POWER SPECTRAL DENSITY

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 6.02 dBi, therefore the limit is 3.98 dBm.

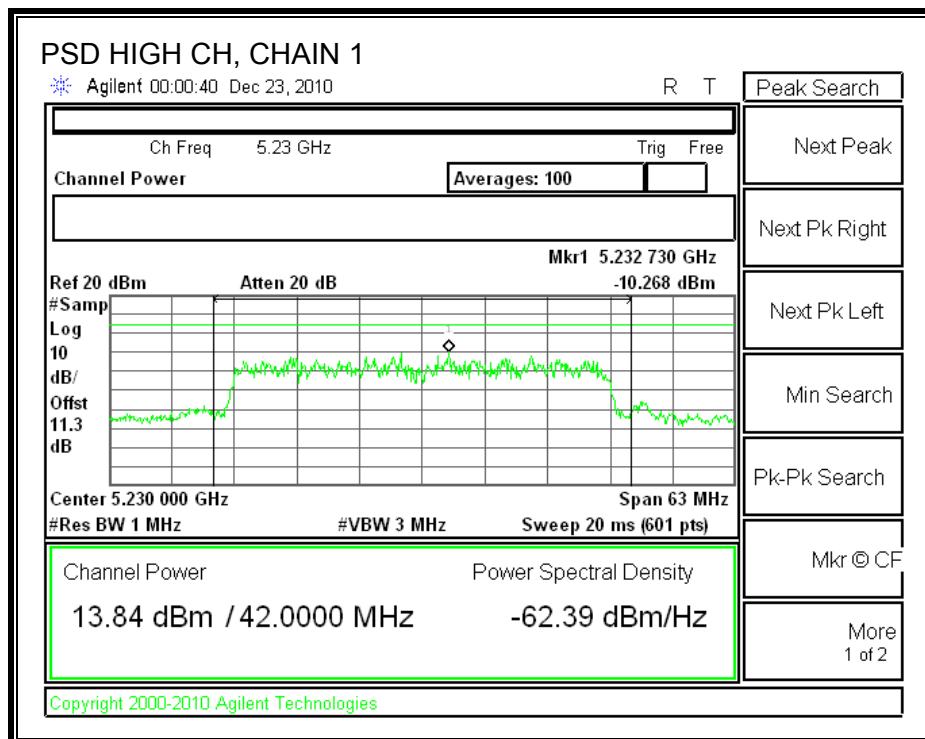
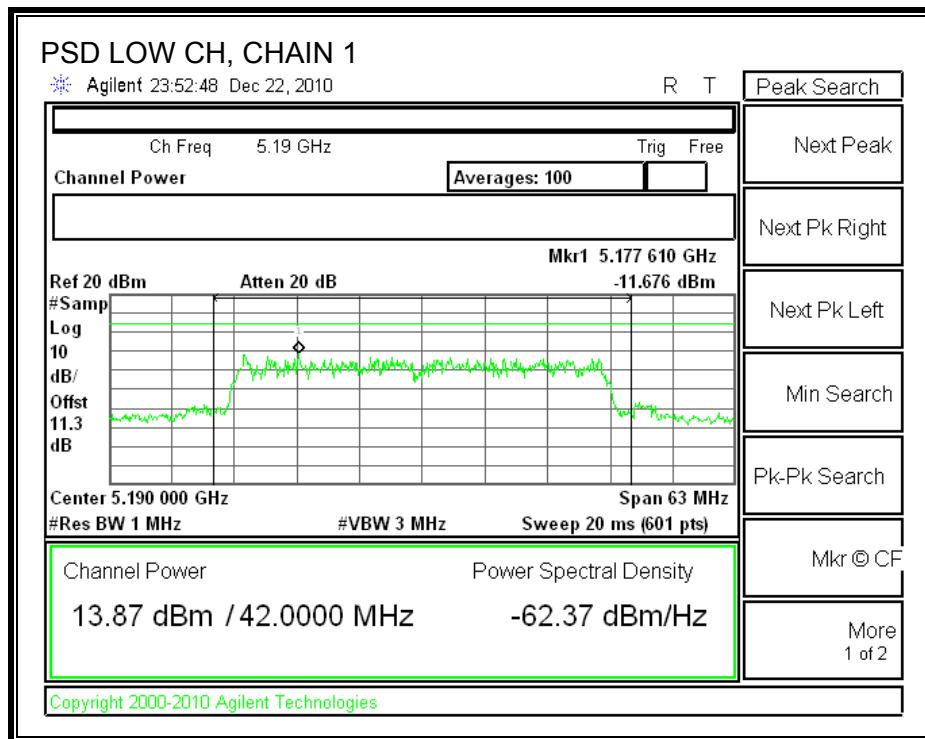
TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

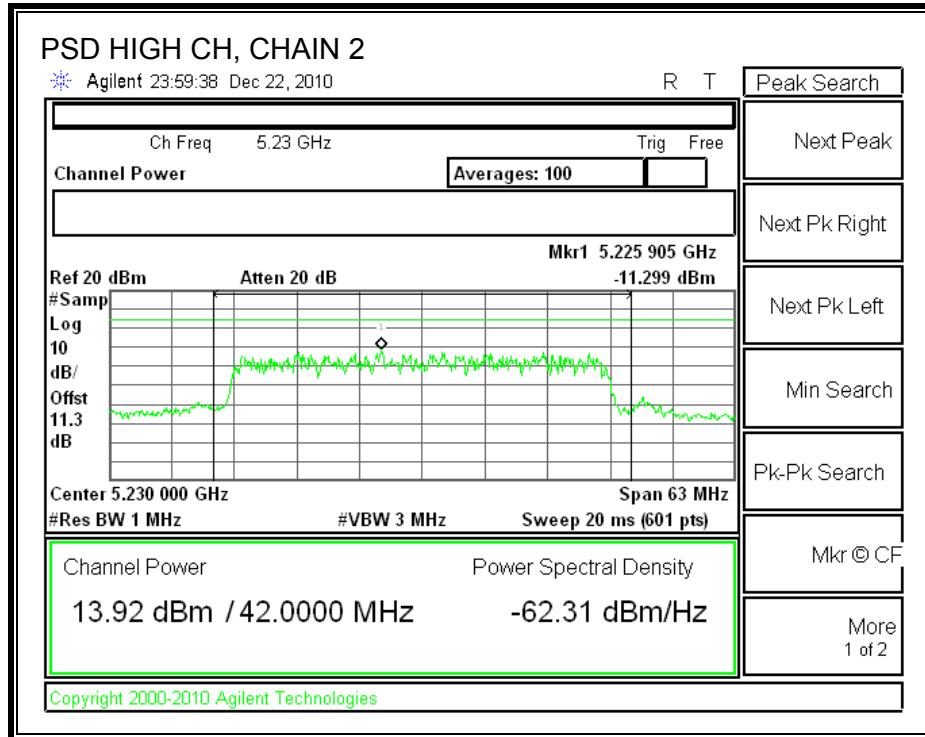
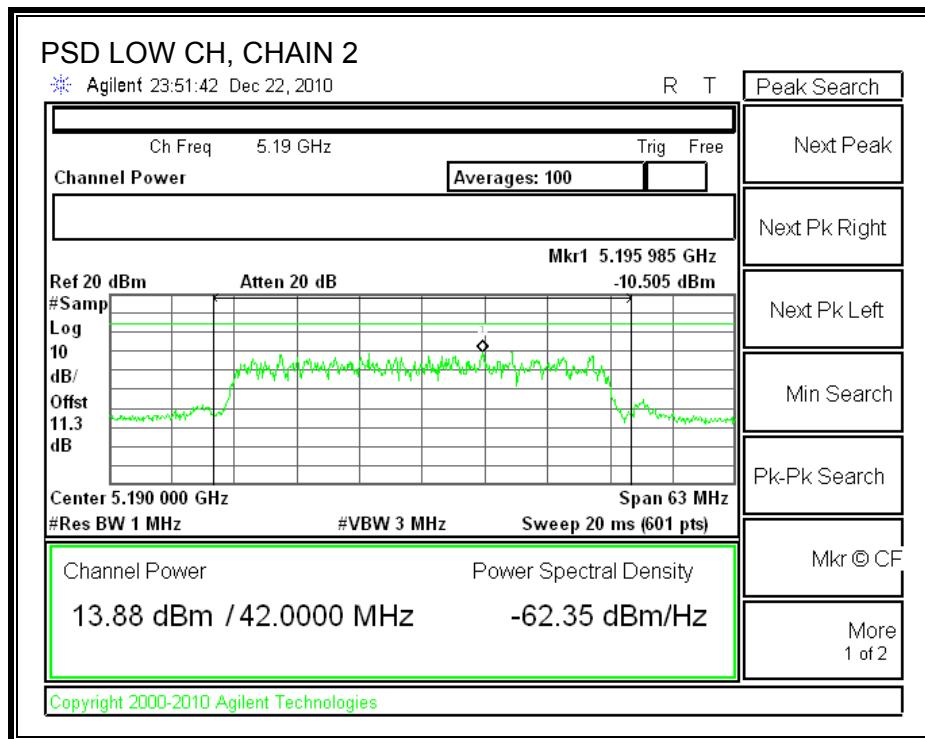
RESULTS

Channel	Frequency (MHz)	Chain 1 PPSD (dBm)	Chain 2 PPSD (dBm)	Total PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5190	-11.676	-10.505	-8.04	3.98	-12.02
High	5230	-10.268	-11.299	-7.74	3.98	-11.72

CHAIN 1 POWER SPECTRAL DENSITY



CHAIN 2 POWER SPECTRAL DENSITY



7.4.14. PEAK EXCURSION

LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

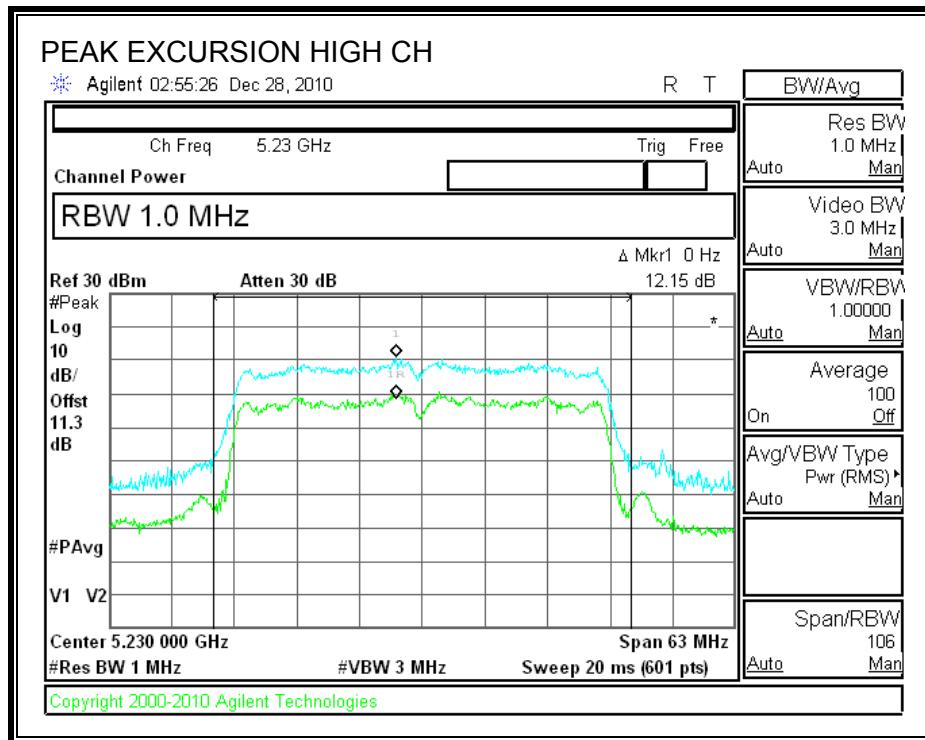
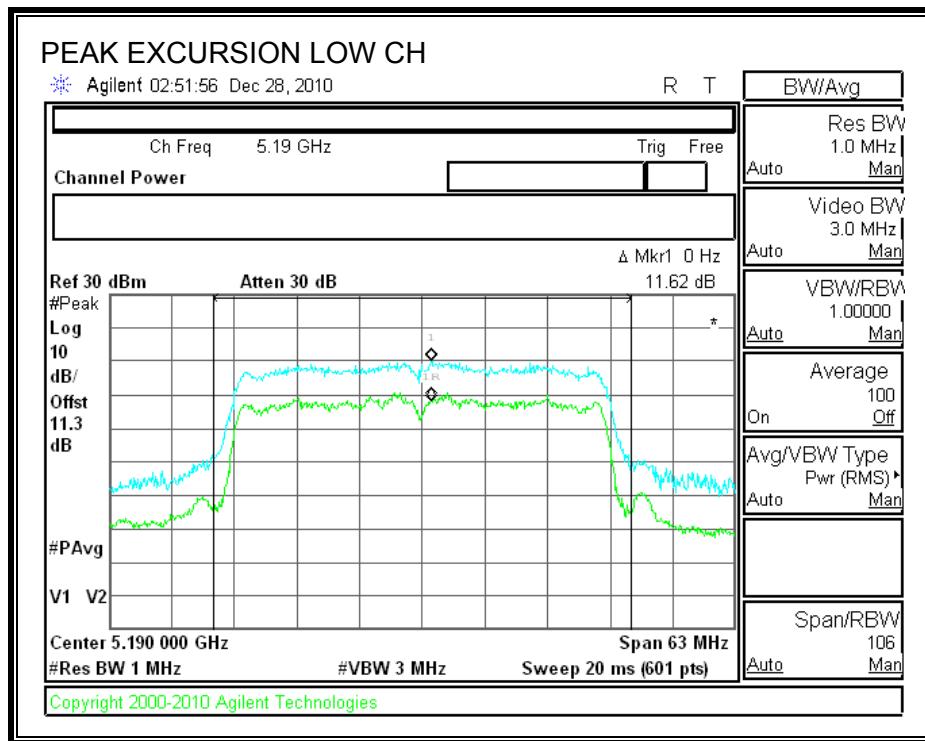
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

RESULTS

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	11.62	13	-1.38
High	5230	12.15	13	-0.85

PEAK EXCURSION



7.4.15. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (1)

For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

TEST PROCEDURE

Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

SPURIOUS EMISSIONS WITH COMBINER

